UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended October 31, 2019

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission File Number 0-19807

SYNOPSYS, INC.
(Exact name of registrant as specified in its charter)

Delaware	**56-1546236**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
690 East Middlefield Road, Mountain View, California	**94043**
(Address of principal executive offices)	(Zip Code)

(650) 584-5000
(Registrant's telephone number, including area code)

Securities Registered Pursuant to Section 12(b) of the Act:

Title of Each Class	Trading Symbol(s)	Name of Each Exchange on Which Registered
Common Stock, $0.01 par value	**SNPS**	**Nasdaq Global Select Market**

Securities Registered Pursuant to Section 12(g) of the Act: **None**

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☒	Accelerated Filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
		Emerging growth company	☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ☐ No ☒

The aggregate market value of the voting and non-voting common equity held by non-affiliates computed by reference to the price at which the common equity was last sold as of the last business day of the registrant's most recently completed second fiscal quarter was approximately $13.7 billion. Aggregate market value excludes an aggregate of approximately 37.5 million shares of common stock held by the registrant's executive officers and directors and by each person known by the registrant to own 5% or more of the outstanding common stock on such date. Exclusion of shares held by any of these persons should not be construed to indicate that such person possesses the power, direct or indirect, to direct or cause the direction of the management or policies of the registrant, or that such person is controlled by or under common control with the registrant.

On December 13, 2019, 150,534,877 shares of the registrant's Common Stock, $0.01 par value, were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement relating to the registrant's 2020 Annual Meeting of Stockholders, scheduled to be held on April 9, 2020, are incorporated by reference into Part III of this Annual Report on Form 10-K where indicated. Except as expressly incorporated by reference, the registrant's Proxy Statement shall not be deemed to be part of this report.

SYNOPSYS, INC.

ANNUAL REPORT ON FORM 10-K
Fiscal year ended October 31, 2019

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Cautionary Note Regarding Forward-Looking Statements

This Annual Report on Form 10-K (this Form 10-K or Annual Report) contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the Securities Act), Section 21E of the Securities Exchange Act of 1934, as amended (the Exchange Act), and the Private Securities Litigation Reform Act of 1995. Any statements herein that are not statements of historical fact are forward-looking statements. Words such as “may,” “will,” “could,” “would,” “can,” “should,” “anticipate,” “expect,” “intend,” “believe,” “estimate,” “project,” “continue,” “forecast,” “likely,” “potential,” “seek,” or the negatives of such terms, and similar expressions are intended to identify forward-looking statements. This Form 10-K includes, among others, forward-looking statements regarding:

- our business, product and platform strategies;
- our business outlook;
- the continuation of current industry trends towards customer and vendor consolidation, and the impact of such consolidation;
- prior and future acquisitions, including the expected benefits and risks of completed acquisitions;
- the impact of macroeconomic conditions and trade disruptions on our business and our customers’ businesses;
- demand for our products and our customers’ products;
- the expected realization of our backlog;
- customer license renewals;
- the completion of development of our unfinished products, or further development or integration of our existing products;
- technological trends in integrated circuit design;
- our ability to successfully compete in the markets in which we serve;
- our license mix, our business model, and variability in our revenue;
- litigation;
- our ability to protect our intellectual property;
- the impact of new and recently adopted accounting pronouncements;
- our cash, cash equivalents and cash generated from operations;
- our available-for-sale securities; and
- our future liquidity requirements.

These statements are based on our current expectations about future events and involve certain known and unknown risks, uncertainties and other factors that could cause our actual results, time frames or achievements to differ materially from those expressed or implied in our forward-looking statements. Accordingly, we caution readers not to place undue reliance on these statements. Such risks and uncertainties include, among others, those listed in Part I, Item 1A, *Risk Factors* of this Form 10-K. The information included herein represents our estimates and assumptions as of the date of this filing. Unless required by law, we undertake no obligation to update publicly any forward-looking statements, or to update the reasons actual results could differ materially from those anticipated in these forward-looking statements, even if new information becomes available in the future. All subsequent written or oral forward-looking statements attributable to Synopsys, Inc. or persons acting on our behalf are expressly qualified in their entirety by these cautionary statements. Readers are urged to carefully review and consider the various disclosures made in this report and in other documents we file from time to time with the Securities and Exchange Commission (SEC) that attempt to advise interested parties of the risks and factors that may affect our business.

Fiscal Year End

Our fiscal year ends on the Saturday nearest to October 31 and consists of 52 weeks, with the exception that approximately every five years, we have a 53-week year. When a 53-week year occurs, we include the additional week in the first quarter to realign fiscal quarters with calendar quarters. Fiscal 2018 was a 53-week year and ended on November 3, 2018. Fiscal 2019 and 2017 were 52-week years and ended on November 2, 2019 and October 28, 2017, respectively. Fiscal 2020 will be a 52-week year.

For presentation purposes, this Form 10-K refers to the closest calendar month end.

PART I

Item 1. *Business*

Company and Segment Overview

Synopsys, Inc. provides products and services used across the entire silicon to software spectrum, from engineers creating advanced semiconductors to software developers seeking to ensure the security and quality of their code.

We are a global leader in supplying the electronic design automation (EDA) software that engineers use to design and test integrated circuits (ICs), also known as chips. We also offer semiconductor intellectual property (IP) products, which are pre-designed circuits that engineers use as components of larger chip designs rather than designing those circuits themselves. We provide software and hardware used to validate the electronic systems that incorporate chips and the software that runs on them. To complement these offerings, we provide technical services and support to help our customers develop advanced chips and electronic systems. These products and services are part of our Semiconductor & System Design segment.

We are also a leading provider of software tools and services that improve the security and quality of software code in a wide variety of industries, including electronics, financial services, media, automotive, medicine, energy and industrials. These tools and services are part of our Software Integrity segment.

Corporate Information

We incorporated in 1986 in North Carolina and reincorporated in 1987 in Delaware. Our headquarters are located at 690 East Middlefield Road, Mountain View, California 94043, and our headquarters' telephone number is (650) 584-5000. We have approximately 120 offices worldwide.

Our annual and quarterly reports on Forms 10-K and 10-Q (including related filings in XBRL format), current reports on Form 8-K, and Proxy Statements relating to our annual meetings of stockholders (including any amendments to these reports, as well as filings made by our executive officers and directors) are available through the Investor Relations page of our website *(www.synopsys.com)* free of charge as soon as practicable after we file them with, or furnish them to, the SEC *(www.sec.gov)*. We use our Investor Relations page as a routine channel for distribution of important information, including news releases, investor presentations, and financial information. The contents of our website are not part of this Form 10-K.

Background

Recent years have seen a remarkable proliferation of consumer and wireless electronic products, particularly mobile devices. The growth of the Internet and cloud computing has provided people with new ways to create, store and share information. At the same time, the increasing use of electronics in cars, buildings, appliances and other consumer products is creating a connected landscape of "smart" devices. Numerous software applications (apps) have been developed to expand the potential of these connected devices. The increasing impact of artificial intelligence and machine learning is driving an increase in the activity of new and existing chip and system design companies around the world.

These developments have been fueled by innovation in the semiconductor and software industries. It is common for a single chip to combine many components (processor, communications, memory, custom logic, input/output) and embedded software into a single system-on-chip (SoC), necessitating highly complex chip designs. The most complex chips today contain more than a billion transistors. Transistors are the basic building blocks for ICs, each of which may have features that are less than 1/1,000th the diameter of a human hair. At such small dimensions, the wavelength of light itself can become an obstacle to production, proving too big to create such dense features and requiring creative and complicated new approaches from designers. Designers have turned to new manufacturing techniques to solve these problems, such as multiple-patterning lithography and FinFET transistors, which in turn have introduced new challenges to design and production.

The popularity of mobile devices and other electronic products has increased demand for chips and systems with greater functionality and performance, reduced size, and lower power consumption. Our customers are the designers of those products and are facing intense pressure to deliver innovative products in shorter timeframes and at lower prices. In other words, innovation in chip and system design often hinges on providing products "better," "sooner," and "cheaper" than competitors. The designs of these chips and systems are extremely complex and necessitate state-of-the-art design solutions.

A similar dynamic is at work in the software arena, whether embedded on a chip or as a standalone. The pace of innovation often requires developers to deliver more secure, high-quality software, which can include millions of lines of code, in increasingly frequent release cycles. Bugs, defects, and security vulnerabilities in code can be difficult to detect and expensive to fix. But, at a time when software is critical in many industries across a growing array of smart devices, it is crucial to have high-quality, secure code to ensure consumers' privacy and safety.

Our Role—The Silicon to Software™ Partner

Synopsys' products and services enable innovators across a variety of markets—from mobile electronics and finance to media, medical, energy, industrial, and automotive—to develop smart and secure products and applications. Across all industries, our customers face tremendous pressure to build differentiated chips and develop robust code more quickly and cost-effectively than ever before. With the increasing amount of embedded software in today's devices, security and quality are top concerns. Synopsys technologies and services are designed to help our customers—both hardware designers and software developers—to speed time to market, achieve the highest quality of results, mitigate risk, and maximize profitability. Our offerings span from silicon to software.

The task of the chip and system designer is to determine how best to design, locate, and connect the building blocks of chips, and to verify that the resulting design behaves as intended and can be manufactured efficiently and cost-effectively. This task is a complex, multi-step process that is both expensive and time-consuming. We offer a wide range of products that help designers at different steps in the overall design process, both for the design of individual ICs and for the design of larger systems. Our products can increase designer productivity and efficiency by automating tasks, keeping track of large amounts of design data, adding intelligence to the design process, facilitating reuse of past designs, and reducing errors. Our IP products offer proven, high-quality pre-configured circuits that are ready-to-use in a chip design, saving customers time and enabling them to direct resources to features that differentiate their products. Our global service and support engineers also provide expert technical support and design assistance to our customers.

The task of the software developer is to write code that not only accomplishes the developer's goal as efficiently as possible, but also runs securely and is free of defects. We offer products that can help developers write higher quality, more secure code by analyzing their code for quality defects and known security vulnerabilities, adding intelligence and automation to the software testing process, and helping to eliminate defects in a systematic manner. To the extent that developers make use of open source software in their code, our products can help developers better manage the composition and security of the code. Our products enable software developers to catch flaws earlier in the development cycle, when they are less costly to fix.

Products and Services

Semiconductor & System Design Segment

Our Semiconductor & System Design segment includes the EDA, IP and System Integration and Other revenue categories.

<u>EDA</u>

The process of designing ICs contains many complex steps: architecture definition, register transfer level (RTL) design, functional/RTL verification, logic design or synthesis, gate-level verification, floorplanning, and place and route, to name just a few. Designers use our EDA products to automate the IC design process and to reduce errors. We offer a platform that features a large number of EDA products intended to address the process comprehensively. Our EDA products generally fall into the following categories:

- Digital and custom IC design and Field Programmable Gate Array (FPGA) design, which includes software tools to design an IC;
- Verification, which includes technology to verify that an IC design behaves as intended; and
- Manufacturing, which includes products that both enable early manufacturing process development and convert IC design layouts into the masks used to manufacture the chips.

Digital and Custom IC Design

Our Fusion Design Platform™ provides customers with a comprehensive digital design implementation solution that includes industry-leading products and incorporates common libraries and consistent timing, delay calculation, UPF power intent descriptions, and constraints throughout the design process. The Fusion Design Platform, which was launched in the fall of 2018, redefines conventional design tool boundaries to deliver a more integrated flow than ever before, with better quality and time to results. The platform gives designers the flexibility to integrate internally developed tools as well as those from third-parties. With innovative technologies, a common foundation, and flexibility, our Fusion Design Platform helps reduce design times, decrease uncertainties in the design steps, and minimize the risks inherent in advanced, complex IC design. The platform supports multiple technology nodes, including advanced nodes at 16/14nm, 12nm, 10nm, and 7/8nm, with technology collaborations at 5nm and below.

Key design products, available as part of the Fusion Design Platform, include Fusion Compiler™ RTL to GDSII design implementation, Design Compiler® logic synthesis, IC Compiler™ II physical design, Synopsys TestMAX™ test and diagnosis, PrimeTime® static timing analysis, StarRC™ parasitic extraction, Ansys RedHawk fusion rail analysis, and IC Validator physical verification.

Our Custom Design Platform™ is a unified suite of design and verification tools that accelerates the development of robust custom and AMS designs. Anchored by the Custom Compiler custom design environment, the platform features industry-leading circuit simulation performance, a fast, easy-to-use custom layout editor complemented with best-in-class technologies for parasitic extraction, reliability analysis, and physical verification. Key features of the Custom Design Platform include reliability-aware verification, visually-assisted layout automation, extraction fusion, and DRC fusion technologies. The platform supports multiple technology nodes, including advanced technology nodes such as 16/14nm, 12nm, 10nm, and 7/8nm, with technology collaborations at 5nm and below.

Our Custom Design Platform is based on the OpenAccess database and includes open APIs for third-party tool integration. Platform tools include HSPICE® and FineSim® SPICE circuit simulators, CustomSim™ FastSPICE, Custom Compiler layout and schematic editor, StarRC parasitic extraction, and IC Validator physical verification.

FPGA Design

FPGAs are complex chips that can be customized or programmed to perform a specific function after they are manufactured. For FPGA design, we offer Synplify® (Pro® and Premier) implementation and Identify® debug software tools.

Verification

Our Verification Continuum™ platform is built from our industry-leading and fastest verification technologies, providing virtual prototyping, static and formal verification, simulation, emulation, FPGA-based prototyping, and debug in a unified environment with verification IP, planning, and coverage technology. By providing consistent compile, runtime and debug environments across the flow of verification tasks and by enabling seamless transitions between simulation, emulation, and prototyping, the platform helps our customers accelerate hardware verification, bring up software earlier, and get to market sooner with advanced SoCs.

The individual products included in the Verification Continuum platform are reported in our EDA and IP and System Integration revenue categories. The solutions reported in our EDA revenue include the following:

- SpyGlass® family of static verification technologies including lint, CDC (clock domain crossing), RDC (reset domain crossing), Synopsys TestMAX Advisor, and low-power analysis and verification;
- VCS® functional verification solution, our comprehensive RTL and gate-level simulation technology, including Fine-Grained Parallelism (FGP);
- Verdi® automated debug system, the industry's most comprehensive SoC debug;
- VC Formal™, our next-generation formal verification product;
- ZeBu® emulation systems, which use high-performance hardware to emulate SoC designs so that designers can accelerate verification of large complex SoCs and perform earlier verification of the SoC together with software; and

- Other principal individual verification solutions, including CustomSim™, FastSPICE and FineSim® SPICE/FastSPICE circuit simulation and analysis products, HSPICE® circuit simulator, and CustomExplorer™ Ultra mixed-signal regression and analysis environment.

The verification IP, virtual prototyping, and FPGA-based prototyping solutions that are part of our Verification Continuum platform are included in our IP and System Integration category and further described below.

Manufacturing

Our Manufacturing Solutions include Sentaurus™ technology computer-aided design (TCAD) device and process simulation products, Proteus™ mask synthesis tools, CATS® mask data preparation software, Yield Explorer® Odyssey, and Yield-Manager® yield management solutions.

We also provide consulting and design services that address all phases of the SoC development process, as well as a broad range of expert training and workshops on our latest tools and methodologies.

IP and System Integration

IP Products

As more functionality converges into a single device or even a single chip, and as chip designs grow more complex, the number of third-party IP blocks incorporated into designs is rapidly increasing. We are a leading provider of high-quality, silicon-proven IP solutions for SoCs. Our broad DesignWare IP portfolio includes:

- High-quality solutions for widely used wired and wireless interfaces such as USB, PCI Express, DDR, Ethernet, SATA, MIPI, HDMI, and Bluetooth Low Energy;
- Logic libraries and embedded memories, including memory compilers, non-volatile memory, standard cells, and integrated test and repair;
- Processor solutions, including configurable ARC® processor cores, software, Embedded Vision processor cores and application-specific instruction-set processor (ASIP) tools for embedded applications;
- IP subsystems for audio, sensor, and data fusion functionality that combine IP blocks, an efficient processor, and software into an integrated, pre-verified subsystem;
- Security IP solutions, including cryptographic cores and software, security subsystems, platform security and content protection IP;
- Analog IP including data converters and audio codecs; and
- SoC infrastructure IP, datapath and building block IP, mathematical and floating-point components, ARM® AMBA® interconnect fabric and peripherals, and verification IP.

Our IP Accelerated initiative augments our established, broad portfolio of silicon-proven DesignWare IP with IP Prototyping Kits and customized IP subsystems to accelerate prototyping, software development, and integration of IP into SoCs.

We offer a broad portfolio of IP that has been optimized to address specific application requirements for the mobile, automotive, digital home, internet of things, and cloud computing markets, enabling designers to quickly develop SoCs in these areas.

Our Verification IP portfolio, part of our Verification Continuum platform, is also part of the IP Products category.

System Integration Solutions

Our System Integration verification solutions include the following elements of our Verification Continuum platform:

- HAPS® FPGA-based prototyping systems, which provide design and verification teams with an integrated and scalable hardware-software solution for early software development and to improve their SoC schedules;

- Virtualizer™ virtual prototyping solution, which addresses the increasing development challenges associated with software-rich semiconductor and electronic products by accelerating both the development and deployment of virtual prototypes; and
- Platform Architect solution, which provides architects and system designers with tools and efficient methods for early analysis and optimization of multi-core SoC architectures for performance and power.

We also provide a series of tools used in the design of optical systems and photonic devices. Our CODE V® solution enables engineers to model, analyze and optimize designs for optical imaging and communication systems. Our LightTools® design and analysis software allows designers to simulate and improve the performance of a broad range of illumination systems, from vehicle lighting to projector systems.

Other

Our Other revenue category includes revenue from sales of products to academic and research institutions.

Software Integrity Segment

Our Software Integrity platform is a comprehensive solution for building integrity—security, quality and compliance testing—into our customers' software development lifecycle and supply chain. These testing tools, services, and programs enable our customers to manage open source license compliance and detect and remediate security vulnerabilities and defects across their entire software development lifecycle. Our offerings include security and quality testing, managed services, programs and professional services, and training.

Key products in the security, quality and compliance testing space include:

- Polaris Software Integrity Platform™, which is designed to provide customers with an easy-to-use and integrated platform that features critical application security products (see below) and certain services. Introduced in April 2019 with its initial configuration, Polaris Software Integrity Platform™ will be enhanced throughout 2020 and beyond;
- Coverity® static analysis tools (including regular critical updates), which analyze software code to find crash-causing bugs, incorrect program behavior, the latest security vulnerabilities, memory leaks and other performance-degrading flaws;
- Defensics® fuzz testing tools, which examine security vulnerabilities in software binaries and libraries, particularly network protocols and file formats, by systematically sending invalid or unexpected inputs to the system under test;
- Black Duck™ software composition analysis tools, which scan binary and source code for license issues and other known security vulnerabilities stemming from incorporated third-party and open source code; and
- Seeker® IAST tool, which identifies exploitable security vulnerabilities while web applications are running, thereby verifying results and eliminating false positives.

Managed services allow developers to test code across many dimensions, and to rapidly respond to changing testing requirements and evolving threats. This includes Mobile Application Security Testing (AST) services to find vulnerabilities in mobile applications as well as Dynamic Application Security Testing (DAST) services which identify security vulnerabilities while web applications are running, without the need for source code.

Programs and professional services address unique security and quality needs with specialized consulting by skilled experts, including the Building Security in Maturity Mode (BSIMM), which measures the effectiveness of software security initiatives by assessing the current state as compared to industry benchmarks, and the Black Duck™ on demand audit services, which provides open source compliance and software vulnerability assessments as part of the due diligence process for mergers and acquisitions.

Finally, training includes eLearning and instructor-led training that prepares developers and security professionals to build security and quality into their software development process and remediate found vulnerabilities and defects.

Customer Service and Technical Support

A high level of customer service and support is critical to the adoption and successful use of our products. We provide technical support for our products through both field-based and corporate-based application engineering teams. Customers that purchase Technology Subscription Licenses (TSLs) receive post-contract customer support bundled with their license fee. Customers that purchase perpetual licenses may purchase these services separately, as further described in *Product Sales and Licensing Agreements* below.

Post-contract customer support includes providing frequent updates and upgrades to maintain the utility of the software due to rapid changes in technology. In our Semiconductor & System Design segment, post-contract customer support for our EDA and IP products also includes access to the SolvNet® portal, where customers can explore our complete design knowledge database. Updated daily, the SolvNet portal includes technical documentation, design tips, and answers to user questions. Customers can also engage, for additional charges, with our worldwide network of applications consultants for additional support needs.

In our Software Integrity segment, post-contract customer support for our products includes access to our support community portal, where customers can access our product documentation, self-service training materials, customer forums and our product knowledge base. Customers can also raise support tickets, request replacement license keys and validate the terms of their active license keys through the portal. Our support community portal is frequently updated with new and supplemental materials on a variety of topics. Customers may engage dedicated support engineers for an additional charge.

In addition, we offer training workshops designed to increase customer design proficiency and productivity with our products. Workshops cover our EDA products and methodologies used in our design and verification flows, as well as specialized modules addressing system design, logic design, physical design, simulation and testing. We offer regularly scheduled public and private courses in a variety of locations worldwide, as well as online training (live or on-demand) through our Virtual Classrooms.

Product Warranties

We generally warrant our products to be free from defects in media and to substantially conform to material specifications for a period of 90 days for our software products and for up to 6 months for our hardware products. In many cases, we also provide our customers with limited indemnification with respect to claims that their use of our software products infringes on United States patents, copyrights, trademarks or trade secrets. We have not experienced material warranty or indemnity claims to date.

Support for Industry Standards

We actively create and support standards that help our EDA and IP customers increase productivity, facilitate efficient design flows, improve interoperability of tools from different vendors, and ensure connectivity, functionality and interoperability of IP building blocks. Standards in the electronic design industry can be established by formal accredited organizations, industry consortia, company licensing made available to all, de facto usage, or through open source licensing.

In our Semiconductor & System Design segment, our EDA products support many standards, including the most commonly used hardware description languages: SystemVerilog, Verilog, VHDL, and SystemC®. Our products utilize numerous industry-standard data formats, APIs, and databases for the exchange of design data among our tools, other EDA vendors' products, and applications that customers develop internally. We also comply with a wide range of industry standards within our IP product family to ensure usability and interconnectivity.

In our Software Integrity segment, our solutions support several existing and emerging industry standards for software coding and security, such as the Motor Industry Software Reliability Association (MISRA) coding standards for the automotive industry. In addition, our products support multiple major programming languages, including C/C++, Objective C, C#, JavaScript (including many commonly used frameworks), and others. In addition, we support many common compilers, development environments, frameworks, and data and file formats.

Sales and Distribution

Our Semiconductor & System Design segment customers are primarily semiconductor and electronics systems companies. The customers for products in our Software Integrity segment include many of these companies as well as companies from a wider array of industries, including electronics, financial services, media, automotive, medicine, energy and industrials.

We market our products and services principally through direct sales in the United States and our principal foreign markets. We typically distribute our software products and documentation to customers electronically, but provide physical media (e.g., DVD-ROMs) when requested by the customer.

We maintain sales and support centers throughout the United States. Outside the United States, we maintain sales, support or service offices in Canada, multiple countries in Europe, Israel and throughout Asia, including Japan, China, Korea, and Taiwan. Our international headquarters are located in Dublin, Ireland. Our offices are further described under Part I, Item 2, *Properties.*

Information relating to domestic and foreign operations, including revenue and long-lived assets by geographic area, is contained in Part II, Item 8, *Financial Statements and Supplementary Data*. Risks related to our foreign operations are described in Part I, Item 1A, *Risk Factors*.

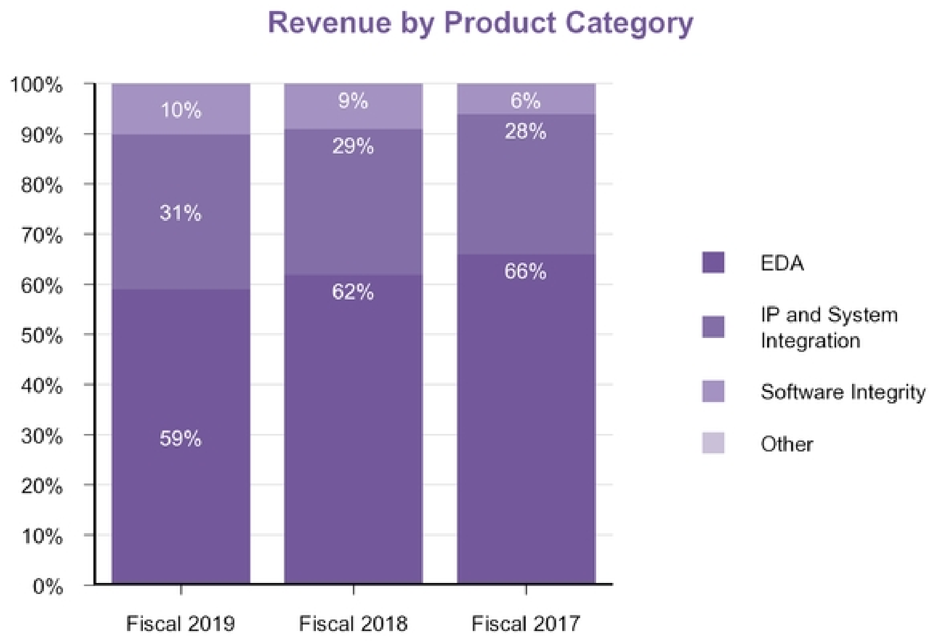
Performance Obligations and Backlog

We adopted the Accounting Standards Update ("ASU") 2014-09, Revenue from Contracts with Customers (ASC 606) at the beginning of fiscal 2019. This revenue standard requires disclosure of revenue allocated to remaining performance obligations. Contracted but unsatisfied or partially unsatisfied performance obligations were approximately $4.4 billion as of October 31, 2019, of which $494.3 million were in non-cancellable commitments from customers who will determine specific products or services selections at a later date. The remaining performance obligations, excluding the non-cancellable commitments, were $3.9 billion, of which 56% are expected to be fulfilled and recognized over the next 12 months.

Our historical backlog was $4.0 billion as of October 31, 2018, primarily representing three years of committed orders which included non-cancellable commitments with future deliverables.

Revenue Attributable to Product Categories and Segments

Beginning in fiscal 2019, we report under two segments: Semiconductor & System Design segment and Software Integrity segment. Revenue attributable to each of our four product categories (with EDA, IP & Systems Integration, and Other comprising our Semiconductor & System Design segment) is shown below as a percentage of our total revenue for those fiscal years.



Aggregate revenue derived from Intel Corporation and its subsidiaries through multiple agreements accounted for 12.8%, 15.4% and 17.9% of our total revenue in fiscal 2019, 2018 and 2017, respectively. In each such year, the revenue derived from Intel Corporation and its subsidiaries was primarily attributable to our Semiconductor & System Design segment. No other customer accounted for more than 10% of our revenue during such periods.

Product Sales and Licensing Agreements

We typically license our software to customers under non-exclusive license agreements that restrict use of our software to specified purposes within specified geographical areas. The majority of licenses to our EDA products are network licenses that allow a number of individual users to access the software on a defined network, including, in some cases, regional or global networks. The majority of licenses to our Software Integrity products are capacity or user licenses that allow a number of users to access the software based on a specified number of team members or specified code-bases in a defined territory. License fees depend on the type of license, product mix, and number of copies of each product licensed.

In a number of cases regarding our EDA products, we provide our customers the right to “re-mix” a portion of the software they initially licensed for other specified Synopsys products. For example, a customer may use our front-end design products for a portion of the license term and then exchange such products for back-end place-and-route software for the remainder of the term in order to complete the customer’s IC design. This practice helps ensure our EDA customer’s access to the complete design flow needed to design their product. Offering remix rights to EDA customers gives us an advantage over competitors who offer a narrower range of EDA products because customers can obtain more of their design flow from a single vendor. At the same time—because in such cases the customer does not need to obtain a new license and pay an additional license fee for the use of the additional EDA products—the use of these arrangements could result in reduced revenue compared to licensing the individual products separately without re-mix rights.

For a full discussion of our software product offerings, see Part II, Item 7, *Management’s Discussion and Analysis of Financial Condition and Results of Operations.*

We typically license our DesignWare IP products under nonexclusive license agreements that provide usage rights for specific applications. Fees under these licenses are typically charged on a per design basis plus, in some cases, royalties. Royalty arrangements are not material to our total revenue.

Our hardware products, which principally consist of our prototyping and emulation systems, are either sold or leased to our customers. Our professional services team typically provides design consulting services to our customers under consulting agreements with statements of work specific to each project.

Competition

The EDA industry is highly competitive. We compete against other EDA vendors and against our customers' own design tools and internal design capabilities. In general, we compete principally on technology leadership, product quality and features (including ease-of-use), license terms, price and payment terms, post-contract customer support, flexibility of tool use, and interoperability with our own and other vendors' products. We also deliver a significant amount of engineering and design consulting for our products. No single factor drives an EDA customer's buying decision, and we compete on all fronts to capture a higher portion of our customers' budgets. Our competitors include EDA vendors that offer varying ranges of products and services, such as Cadence Design Systems, Inc. and Mentor Graphics Corporation (now part of Siemens AG). We also compete with other EDA vendors, including new entrants to the marketplace, that offer products focused on one or more discrete phases of the IC design process, as well as with customers' internally developed design tools and capabilities.

Our Semiconductor & System Design segment competes against numerous other IP providers, including Cadence Design Systems, Inc., and our customers' internally developed IP. We generally compete on the basis of product quality, reliability and features, ease of integration with customer designs, compatibility with design tools, license terms, price and payment terms, and customer support.

Our Software Integrity segment competes with numerous other solution providers, many of which focus on specific aspects of software security or quality analysis. We also compete with frequent new entrants, which include start-up companies and more established software companies. For example, competitors named in the Gartner Magic Quadrant for Application Security Testing include Checkmarx Ltd., Veracode (now part of Thoma Bravo, LLC) and Micro Focus International plc.

Proprietary Rights

We primarily rely upon a combination of copyright, patent, trademark, and trade secret laws and license and non-disclosure agreements to establish and protect our proprietary rights. We have a diversified portfolio of more than 3,200 United States and foreign patents issued, and we will continue to pursue additional patents in the future. Our issued patents have expiration dates through 2039. Our patents primarily relate to our products and the technology used in connection with our products. Our source code is protected both as a trade secret and as an unpublished copyrighted work. However, third parties may independently develop similar technology. In addition, effective copyright and trade secret protection may be unavailable or limited in some foreign countries. While protecting our proprietary technology is important to our success, our business as a whole is not significantly dependent upon any single patent, copyright, trademark, or license.

In many cases, under our customer agreements and other license agreements, we offer to indemnify our customers if the licensed products infringe on a third party's intellectual property rights. As a result, we may from time to time need to defend claims that our customers' use of our products infringes on these third-party rights. We license software and other intellectual property from third parties, including, in several instances, for inclusion in our products. Risks related to our use of third-party technology are described in Part I, Item 1A, *Risk Factors.*

Employees

As of October 31, 2019, Synopsys had 13,896 employees, of which 4,512 were based in the United States.

Information about our Executive Officers

The executive officers of Synopsys and their ages as of December 20, 2019 were as follows:

Name	Age	Position
Aart J. de Geus	65	Co-Chief Executive Officer and Chairman of the Board of Directors
Chi-Foon Chan	70	Co-Chief Executive Officer and President
Trac Pham	50	Chief Financial Officer
Joseph W. Logan	60	Sales and Corporate Marketing Officer
John F. Runkel, Jr.	64	General Counsel and Corporate Secretary

Aart J. de Geus co-founded Synopsys and has served as Chairman of our Board of Directors since February 1998 and Chief Executive Officer since January 1994. He has served as Co-Chief Executive Officer with Dr. Chi-Foon Chan since May 2012. Since the inception of Synopsys in December 1986, Dr. de Geus has held a variety of positions, including President, Senior Vice President of Engineering and Senior Vice President of Marketing. He has served as a member of Synopsys' Board of Directors since 1986, and served as Chairman of our Board from 1986 to 1992 and again from 1998 until present. Dr. de Geus has also served on the board of directors of Applied Materials, Inc. since July 2007. Dr. de Geus holds an M.S.E.E. from the Swiss Federal Institute of Technology in Lausanne, Switzerland and a Ph.D. in Electrical Engineering from Southern Methodist University.

Chi-Foon Chan has served as our Co-Chief Executive Officer since May 2012 and as our President and a member of our Board of Directors since February 1998. Prior to his appointment as our Co-Chief Executive Officer in May 2012, he had served as our Chief Operating Officer since April 1997. Dr. Chan joined Synopsys in May 1990 and has held various senior management positions, including Executive Vice President, Office of the President from September 1996 to February 1998 and Senior Vice President, Design Tools Group from February 1994 to April 1997. Dr. Chan has also held senior management and engineering positions at NEC Electronics and Intel Corporation. Dr. Chan holds a B.S. in Electrical Engineering from Rutgers University, and an M.S. and a Ph.D. in Computer Engineering from Case Western Reserve University.

Trac Pham is our Chief Financial Officer. Mr. Pham joined Synopsys in November 2006 as Vice President, Financial Planning and Strategy. He became our Vice President, Corporate Finance, in August 2012, assuming additional responsibility for our tax and treasury functions, before being appointed Chief Financial Officer in December 2014. Mr. Pham holds a Bachelor of Arts in Economics from the University of California, Berkeley and an MPIA (Master of Pacific International Affairs) from the University of California, San Diego. He is an active status California CPA.

Joseph W. Logan serves as our Sales and Corporate Marketing Officer. He became Senior Vice President of Worldwide Sales in September 2006 and assumed responsibility for our Corporate Marketing organization in August 2013. Previously, Mr. Logan was head of sales for Synopsys' North America East region from September 2001 to September 2006. Prior to Synopsys, Mr. Logan was head of North American Sales and Support at Avant! Corporation. Mr. Logan holds a B.S.E.E. from the University of Massachusetts, Amherst.

John F. Runkel, Jr. has served as our General Counsel and Corporate Secretary since May 2014. From October 2008 to March 2013, he was Executive Vice President, General Counsel, and Corporate Secretary of Affymetrix, Inc. He served as Senior Vice President, General Counsel and Corporate Secretary of Intuitive Surgical, Inc. from 2006 to 2007. Mr. Runkel served in several roles at VISX, Inc. from 2001 to 2005, most recently as Senior Vice President of Business Development and General Counsel. Mr. Runkel was also a partner at the law firm of Sheppard, Mullin, Richter & Hampton LLP for 11 years. He holds a Bachelor of Arts and a Juris Doctorate from the University of California, Los Angeles.

There are no family relationships among any Synopsys executive officers or directors.

Item 1A. *Risk Factors*

A description of the risk factors associated with our business is set forth below. Investors should carefully consider these risks and uncertainties before investing in our common stock.

The growth of our business depends primarily on the semiconductor and electronics industries.

The growth of the electronic design automation (EDA) industry as a whole, our Semiconductor & System Design segment product sales, and to some extent our Software Integrity segment product sales, is dependent on the semiconductor and electronics industries. A substantial portion of our business and revenue depends upon the commencement of new design projects by semiconductor manufacturers, systems companies, and their customers. The increasing complexity of designs of systems-on-chips, integrated circuits, electronic systems and customers' concerns about managing costs, have previously led and in the future could lead to a decrease in design starts and design activity in general, with some customers focusing more on one discrete phase of the design process or opting for less advanced, but less risky, manufacturing processes that may not require the most advanced EDA products. Demand for our products and services could decrease and our financial condition and results of operations could be adversely affected if growth in the semiconductor and electronics industries slows or stalls. Additionally, as the EDA industry has matured, consolidation has resulted in stronger competition from companies better able to compete as sole source vendors. This increased competition may cause our revenue growth rate to decline and exert downward pressure on our operating margins, which may have an adverse effect on our business and financial condition.

Furthermore, the semiconductor and electronics industries have become increasingly complex ecosystems. Many of our customers outsource the manufacture of their semiconductor designs to foundries. Our customers also frequently incorporate third-party IP, whether provided by us or other vendors, into their designs to improve the efficiency of their design process. We work closely with major foundries to ensure that our EDA, IP, and manufacturing solutions are compatible with their manufacturing processes. Similarly, we work closely with other major providers of semiconductor IP, particularly microprocessor IP, to optimize our EDA tools for use with their IP designs and to assure that their IP and our own IP products, which may each provide for the design of separate components on the same chip, work effectively together. If we fail to optimize our EDA and IP solutions for use with major foundries' manufacturing processes or major IP providers' products, or if our access to such foundry processes or third-party IP products is hampered, then our solutions may become less desirable to our customers, resulting in an adverse effect on our business and financial condition.

Consolidation among our customers and within the industries in which we operate, as well as our dependence on a relatively small number of large customers, may negatively impact our operating results.

A number of business combinations, including mergers, asset acquisitions and strategic partnerships, among our customers in the semiconductor and electronics industries have occurred over the last several years, and more could occur in the future. Consolidation among our customers could lead to fewer customers or the loss of customers, increased customer bargaining power, or reduced customer spending on software and services. Furthermore, we depend on a relatively small number of large customers, and on such customers continuing to renew licenses and purchase additional products from us, for a large portion of our revenue. Reduced customer spending or the loss of a small number of customers, particularly our large customers, could adversely affect our business and financial condition. In addition, we and our competitors from time to time acquire businesses and technologies to complement and expand our respective product offerings. If any of our competitors consolidate or acquire businesses and technologies which we do not offer, they may be able to offer a larger technology portfolio, additional support and service capability, or lower prices, which could negatively impact our business and operating results.

The global nature of our operations exposes us to increased risks and compliance obligations that may adversely affect our business.

We derive roughly half of our revenue from sales outside the United States, and we expect our orders and revenue to continue to depend on sales to customers outside the U.S. We have also continually expanded our non-U.S. operations. This strategy requires us to recruit and retain qualified technical and managerial employees, manage multiple remote locations performing complex software development projects and ensure intellectual property protection outside of the U.S. Our international operations and sales subject us to a number of increased risks, including:

- Ineffective or weaker legal protection of intellectual property rights;
- Uncertain economic and political conditions in countries where we do business;
- Government trade restrictions, including tariffs, export licenses, or other trade barriers, and changes to existing trade arrangements between various countries;
- Difficulties in adapting to cultural differences in the conduct of business, which may include business practices in which we are prohibited from engaging by the Foreign Corrupt Practices Act or other anti-corruption laws;
- Financial risks such as longer payment cycles and difficulty in collecting accounts receivable;
- Inadequate local infrastructure that could result in business disruptions;
- Additional taxes, interest, and potential penalties, and uncertainty around changes in tax laws of various countries; and
- Other factors beyond our control such as natural disasters, terrorism, civil unrest, war and infectious diseases.

Furthermore, if any of the foreign economies in which we do business deteriorate or if we fail to effectively manage our global operations, our business and results of operations will be harmed.

As our business volume increases in the Asia Pacific region, there is inherent risk, based on the complex relationships between certain Asian countries and the United States, that political, diplomatic, or military events could result in trade disruptions, including tariffs, trade embargoes, export restrictions and other trade barriers. A significant trade disruption, export restriction, or the establishment or increase of any trade barrier in any area where we do business could reduce customer demand and cause customers to search for substitute products and services, make our products and services more expensive or unavailable for customers, increase the cost of our products and services, have a negative impact on customer confidence and spending, make our products less competitive, or otherwise have a materially adverse impact on our future revenue and profits, our customers' and suppliers' businesses, and our results of operations.

For example, beginning in May 2019, the United States government placed certain entities on the “Entity List,” restricting the sale of U.S. technologies to the named entities. As a result of this government action, we are not able to book new business with these entities, and revenue associated with these entities is put “on hold” until either the contract expires, or the restriction is lifted. In response to that action or similar actions taken by the United States, other countries may adopt tariffs and trade barriers that could limit our ability to offer our products and services. Current and potential customers who are concerned or affected by such tariffs or restrictions may respond by developing their own products or replacing our solutions, which would have an adverse effect on our business. In addition, government or customer efforts, attitudes, laws, or policies regarding technology independence may lead to non-U.S. customers favoring their domestic technology solutions that could compete with or replace our products, which would also have an adverse effect on our business.

In addition to tariffs and other trade barriers, our global operations are subject to numerous U.S. and foreign laws and regulations, including those related to anti-corruption, tax, corporate governance, imports and exports, financial and other disclosures, privacy and labor relations. These laws and regulations are complex and may have differing or conflicting legal standards, making compliance difficult and costly. In addition, there is uncertainty regarding how proposed, contemplated or future changes to these complex laws and regulations could affect our business. We may incur substantial expense in complying with the new obligations to be imposed by these laws and regulations, and we may be required to make significant changes in our business operations, all of which may adversely affect our revenues and our business overall. If we violate these laws and regulations we could be subject to fines, penalties or criminal sanctions, and may be prohibited from conducting business in one or more countries. Although we have implemented policies and procedures to help ensure compliance with these laws and regulations, there can be no assurance that our employees, contractors, agents or partners will not violate such laws and regulations. Any violation individually or in the aggregate could have a material adverse effect on our operations and financial condition.

Our financial results are also affected by fluctuations in foreign currency exchange rates. A weakening U.S. dollar relative to other currencies increases expenses of our foreign subsidiaries when they are translated into U.S. dollars in our consolidated statements of operations. Likewise, a strengthening U.S. dollar relative to other currencies, including the renminbi or Yen, reduces revenue of our foreign subsidiaries upon translation and consolidation. Exchange rates are subject to significant and rapid fluctuations, and therefore we cannot predict the prospective impact of exchange rate fluctuations. Although we engage in foreign currency hedging activity, we may be unable to hedge all of our foreign currency risk, which could have a negative impact on our results of operations.

Uncertainty in the global economy, and its potential impact on the semiconductor and electronics industries in particular, may negatively affect our business, operating results and financial condition.

While the global economy has been relatively strong in recent years, there are still uncertainties surrounding the strength of economic recovery in many regions. Uncertainty caused by challenging global economic conditions could lead some of our customers to postpone their decision-making, decrease their spending and/or delay their payments to us. Such caution by customers could, among other things, limit our ability to maintain or increase our sales or recognize revenue from committed contracts.

We cannot predict the stability of the economy as a whole or the industries in which we operate. Further economic instability could adversely affect the banking and financial services industry and result in credit downgrades of the banks we rely on for foreign currency forward contracts, credit and banking transactions, and deposit services, or cause them to default on their obligations. There is uncertainty regarding how proposed, contemplated or future changes to the complex laws and regulations governing our industry, the banking and financial services industry, and the economy could affect our business. In addition, economic conditions could deteriorate in the future, and, in particular, the semiconductor and electronics industries could fail to grow, including as the result of any disruption of international trade relationships. In the event of future improvements in economic conditions for our customers, the positive impact on our revenues and financial results may be deferred due to our business model. Any of the foregoing could cause adverse effects on our business, operating results and financial condition, and could cause our stock price to decline.

Our operating results may fluctuate in the future, which may adversely affect our stock price.

Our operating results are subject to quarterly and annual fluctuations, which may adversely affect our stock price. Our historical results should not be viewed as indicative of our future performance due to these periodic fluctuations.

Many factors may cause our revenue or earnings to fluctuate, including:

- Changes in demand for our products—especially products, such as hardware, generating upfront revenue—due to fluctuations in demand for our customers' products and due to constraints in our customers' budgets for research and development and EDA products and services;
- Product competition in the EDA industry, which can change rapidly due to industry or customer consolidation and technological innovation;
- Our ability to innovate and introduce new products and services or effectively integrate products and technologies that we acquire;
- Failures or delays in completing sales due to our lengthy sales cycle, which often includes a substantial customer evaluation and approval process because of the complexity of our products and services;
- Our ability to implement effective cost control measures;
- Our dependence on a relatively small number of large customers, and on such customers continuing to renew licenses and purchase additional products from us, for a large portion of our revenue;
- Changes to the amount, composition and valuation of, and any impairments to or write-offs of, our inventory;
- Changes in the mix of our products sold, as increased sales of our products with lower gross margins, such as our hardware products, may reduce our overall margins;
- Expenses related to our acquisition and integration of businesses and technology;
- Changes in tax rules, as well as changes to our effective tax rate, including the tax effects of infrequent or unusual transactions and tax audit settlements;
- Delays, increased costs or quality issues resulting from our reliance on third parties to manufacture our hardware products, which includes a sole supplier for certain hardware components;
- Natural variability in the timing of IP drawdowns, which can be difficult to predict;
- General economic and political conditions that affect the semiconductor and electronics industries, such as disruptions to international trade relationships, including tariffs, export licenses, or other trade barriers affecting our or our suppliers' products; and
- Changes in accounting standards, which may impact the way we recognize our revenue and costs and impact our earnings.

The timing of revenue recognition may also cause our revenue and earnings to fluctuate. The timing of revenue recognition is affected by factors that include:

- Cancellations or changes in levels of orders or the mix between upfront products revenue and time-based products revenue;
- Delay of one or more orders for a particular period, particularly orders generating upfront products revenue, such as hardware;
- Delay in the completion of professional services projects that require significant modification or customization and are accounted for using the percentage of completion method;
- Delay in the completion and delivery of IP products in development as to which customers have paid for early access;
- Customer contract amendments or renewals that provide discounts or defer revenue to later periods;
- The levels of our hardware and IP revenues, which are recognized upfront and are primarily dependent upon our ability to provide the latest technology and meet customer requirements; and
- Changes in our revenue recognition model.

These factors, or any other factors or risks discussed herein, could negatively impact our revenue or earnings and cause our stock price to decline. Additionally, our results may fail to meet or exceed the expectations of securities analysts and investors, or such analysts may change their recommendation regarding our stock, which could cause our stock price to decline. Our stock price has been, and may continue to be, volatile, which may make it more difficult for our stockholders to sell their shares at a time or a price that is favorable to them.

We operate in highly competitive industries, and if we do not continue to meet our customers' demand for innovative technology at lower costs, our products may become uncompetitive and obsolete, and our business and financial condition may be harmed.

In our Semiconductor & System Design segment, we compete against EDA vendors that offer a variety of products and services, such as Cadence Design Systems, Inc. and Mentor Graphics Corporation (now part of Siemens AG). We also compete with other EDA vendors, including new entrants to the marketplace, that offer products focused on one or more discrete phases of the IC design process. Moreover, our customers internally develop design tools and capabilities that compete with our products, including internal designs that compete with our IP products. In the area of IP products, we compete against numerous other IP providers as well as our customers' internally developed IP.

In our Software Integrity segment, we compete with numerous other solution providers, many of which focus on specific aspects of software security or quality analysis. We also compete with frequent new entrants, which include start-up companies and more established software companies.

The industries in which we operate are highly competitive and the demand for our products and services is dynamic and depends on a number of factors, including demand for our customers' products, design starts and our customers' budgetary constraints. Technology in these industries evolves rapidly and is characterized by frequent product introductions and improvements as well as changes in industry standards and customer requirements. Semiconductor device functionality requirements continually increase while feature widths decrease, substantially increasing the complexity, cost and risk of chip design and manufacturing. At the same time, our customers and potential customers continue to demand an overall lower total cost of design, which can lead to the consolidation of their purchases with one vendor. In order to succeed in this environment, we must successfully meet our customers' technology requirements and increase the value of our products, while also striving to reduce their overall costs and our own operating costs.

We compete principally on the basis of technology, product quality and features (including ease-of-use), license or usage terms, post-contract customer support, interoperability among products, and price and payment terms. Specifically, we believe the following competitive factors affect our success:

- Our ability to anticipate and lead critical development cycles and technological shifts, innovate rapidly and efficiently, improve our existing software and hardware products, and successfully develop or acquire such new products;
- Our ability to offer products that provide both a high level of integration into a comprehensive platform and a high level of individual product performance;
- Our ability to enhance the value of our offerings through more favorable terms such as expanded license usage, future purchase rights, price discounts and other differentiating rights, such as

multiple tool copies, post-contract customer support, “re-mix” rights that allow customers to exchange the software they initially licensed for other Synopsys products, and the ability to purchase pools of technology;
- Our ability to compete on the basis of payment terms; and
- Our ability to provide engineering and design consulting for our products.

If we fail to successfully manage these competitive factors, fail to successfully balance the conflicting demands for innovative technology and lower overall costs, or fail to address new competitive forces, our business and financial condition will be adversely affected.

Cybersecurity threats or other security breaches could compromise sensitive information belonging to us or our customers and could harm our business and our reputation, particularly that of our security testing solutions.

We store sensitive data, including intellectual property, our proprietary business information and that of our customers, and confidential employee information, in our data centers and on our networks. Despite our security measures, our information technology and infrastructure may be vulnerable to attacks by hackers or breached due to employee error, malfeasance or other disruptions that could result in unauthorized disclosure or loss of sensitive information.

For example, we discovered unauthorized third-party access to our products and product license files hosted on our SolvNet customer license and product delivery system in 2015. We determined that no customer project or design data had been accessed. No personally identifiable information or payment card information is stored on the system. While we identified and closed the method used to gain access, it is possible that our security measures may be circumvented again in the future, and such a breach could harm our business and reputation. The techniques used to obtain unauthorized access to networks, or to sabotage systems, change frequently and generally are not recognized until launched against a target. We may be unable to anticipate these techniques or to implement adequate preventative measures. Furthermore, in the operation of our business we also use third-party vendors that store certain sensitive data, including confidential information about our employees, and these third parties are subject to their own cybersecurity threats. While our standard vendor terms and conditions include provisions requiring the use of appropriate security measures to prevent unauthorized use or disclosure of our data, as well as other safeguards, a breach may still occur. Any security breach of our own or a third-party vendor’s systems could cause us to be non-compliant with applicable laws or regulations, subject us to legal claims or proceedings, disrupt our operations, damage our reputation, and cause a loss of confidence in our products and services, any of which could adversely affect our business.

Our software products, including our hosted solutions as well as our software security and quality testing solutions, may also be vulnerable to cyber attacks. An attack could disrupt the proper functioning of our software, cause errors in the output of our customers’ work, allow unauthorized access to our or our customers’ proprietary information, and other destructive outcomes. As a result, our reputation could suffer, customers could stop buying our products, we could face lawsuits and potential liability, and our financial performance could be negatively impacted.

We offer software security and quality testing solutions. If we fail to identify new and increasingly sophisticated methods of cyber attacks, or fail to invest sufficient resources in research and development regarding new threat vectors, our security testing products and services may fail to detect vulnerabilities in our customers’ software code. An actual or perceived failure to identify security flaws may harm the perceived reliability of our security testing products and services, and could result in a loss of customers or sales, or an increased cost to remedy a problem. Furthermore, our growth and recent acquisitions in the software security and quality testing space may increase our visibility as a security-focused company and may make us a more attractive target for attacks on our own information technology infrastructure. Successful attacks could damage our reputation as a security-focused company.

If we fail to protect our proprietary technology, our business will be harmed.

Our success depends in part upon protecting our proprietary technology. Our efforts to protect our technology may be costly and unsuccessful. We rely on agreements with customers, employees and other third-parties as well as intellectual property laws worldwide to protect our proprietary technology. These agreements may be breached, and we may not have adequate remedies for any breach. Additionally, despite our measures to prevent piracy, other parties may attempt to illegally copy or use our products, which could result in lost revenue. Some foreign countries do not currently provide effective legal protection for intellectual property and our ability to prevent the unauthorized use of our products in those countries is therefore limited. Our trade secrets may also be stolen, otherwise become known, or be independently developed by competitors.

We may need to commence litigation or other legal proceedings in order to:

- Assert claims of infringement of our intellectual property;
- Defend our products from piracy;
- Protect our trade secrets or know-how; or
- Determine the enforceability, scope and validity of the propriety rights of others.

If we do not obtain or maintain appropriate patent, copyright or trade secret protection, for any reason, or cannot fully defend our intellectual property rights in certain jurisdictions, our business and operating results would be harmed. In addition, intellectual property litigation is lengthy, expensive and uncertain. Legal fees related to such litigation will increase our operating expenses and may reduce our net income.

We may not be able to realize the potential financial or strategic benefits of the acquisitions we complete, or find suitable target businesses and technology to acquire, which could hurt our ability to grow our business, develop new products or sell our products.

Acquisitions and strategic investments are an important part of our growth strategy. We have completed a significant number of acquisitions in recent years. We expect to make additional acquisitions and strategic investments in the future, but we may not find suitable acquisition or investment targets or we may not be able to consummate desired acquisitions or investments due to unfavorable credit markets, commercially unacceptable terms, or other risks, which could harm our operating results. Acquisitions and strategic investments are difficult, time-consuming, and pose a number of risks, including:

- Potential negative impact on our earnings per share;
- Failure of acquired products to achieve projected sales;
- Problems in integrating the acquired products with our products;
- Difficulties entering into new markets in which we are not experienced or where competitors may have stronger positions;
- Potential downward pressure on operating margins due to lower operating margins of acquired businesses, increased headcount costs and other expenses associated with adding and supporting new products;
- Difficulties in retaining and integrating key employees;
- Substantial reductions of our cash resources and/or the incurrence of debt;
- Failure to realize expected synergies or cost savings;
- Difficulties in integrating or expanding sales, marketing and distribution functions and administrative systems, including information technology and human resources systems;
- Dilution of our current stockholders through the issuance of common stock as part of the merger consideration;
- Difficulties in negotiating, governing and realizing value from strategic investments;
- Assumption of unknown liabilities, including tax and litigation, and the related expenses and diversion of resources;
- Disruption of ongoing business operations, including diversion of management's attention and uncertainty for employees and customers, particularly during the post-acquisition integration process;
- Potential negative impacts on our relationships with customers, distributors and business partners;
- Exposure to new operational risks, regulations, and business customs to the extent acquired businesses are located in regions where we are not currently conducting business;
- The need to implement controls, processes and policies appropriate for a public company at acquired companies that may have lacked such controls, processes and policies;

- Negative impact on our net income resulting from acquisition or investment-related costs; and
- Requirements imposed by government regulators in connection with their review of an acquisition, including required divestitures or restrictions on the conduct of our business or the acquired business.

If we do not manage the foregoing risks, the acquisitions or strategic investments that we complete may have an adverse effect on our business and financial condition.

We pursue new product and technology initiatives from time to time, and if we fail to successfully carry out these initiatives, our business, financial condition, or results of operations could be adversely impacted.

As part of the evolution of our business, we have made substantial investments to develop new products and enhancements to existing products through our acquisitions and research and development efforts. If we are unable to anticipate technological changes in our industry by introducing new or enhanced products in a timely and cost-effective manner, or if we fail to introduce products that meet market demand, we may lose our competitive position, our products may become obsolete, and our business, financial condition or results of operations could be adversely affected.

Additionally, from time to time, we invest in expansion into adjacent markets, including software security and quality testing solutions. Although we believe these solutions are complementary to our EDA tools, we have less experience and a more limited operating history in offering software quality testing and security products and services, and our efforts in this area may not be successful. Our success in these new markets depends on a variety of factors, including the following:

- Our ability to attract a new customer base, including in industries in which we have less experience;
- Our successful development of new sales and marketing strategies to meet customer requirements;
- Our ability to accurately predict, prepare for, and promptly respond to technological developments in new fields, including, in the case of our software quality testing and security tools and services, identifying new security vulnerabilities in software code and ensuring support for a growing number of programming languages;
- Our ability to compete with new and existing competitors in these new industries, many of which may have more financial resources, industry experience, brand recognition, relevant intellectual property rights, or established customer relationships than we currently do, and could include free and open source solutions that provide similar software quality testing and security tools without fees;
- Our ability to skillfully balance our investment in adjacent markets with investment in our existing products and services;
- Our ability to attract and retain employees with expertise in new fields;
- Our ability to sell and support consulting services at profitable margins; and
- Our ability to manage our revenue model in connection with hybrid sales of licensed products and consulting services.

Difficulties in any of our new product development efforts or our efforts to enter adjacent markets could adversely affect our operating results and financial condition.

We may have to invest more resources in research and development than anticipated, which could increase our operating expenses and negatively affect our operating results.

We devote substantial resources to research and development. New competitors, technological advances in the semiconductor industry or by competitors, our acquisitions, our entry into new markets, or other competitive factors may require us to invest significantly greater resources than we anticipate. If we are required to invest significantly greater resources than anticipated without a corresponding increase in revenue, our operating results could decline. Additionally, our periodic research and development expenses may be independent of our level of revenue, which could negatively impact our financial results. Finally, there can be no guarantee that our research and development investments will result in products that create additional revenue.

Product errors or defects could expose us to liability and harm our reputation and we could lose market share.

Software products frequently contain errors or defects, especially when first introduced, when new versions are released, or when integrated with technologies developed by acquired companies. Product errors, including those resulting from third-party suppliers, could affect the performance or interoperability of our products, could delay the development or release of new products or new versions of products and could adversely affect market acceptance or perception of our products. In addition, any allegations of manufacturability issues resulting from use of our IP products could, even if untrue, adversely affect our reputation and our customers’ willingness to license IP products from us. Any such errors or delays in releasing new products or new versions of products or allegations of unsatisfactory performance could cause us to lose customers, increase our service costs, subject us to liability for damages and divert our resources from other tasks, any one of which could materially and adversely affect our business and operating results.

Our hardware products, which primarily consist of prototyping and emulation systems, subject us to distinct risks.

The growth in sales of our hardware products subjects us to several risks, including:

- Increased dependence on a sole supplier for certain hardware components, which may reduce our control over product quality and pricing and may lead to delays in production and delivery of our hardware products, should our supplier fail to deliver sufficient quantities of acceptable components in a timely fashion;
- Increasingly variable revenue and decreasingly accurate revenue forecasts, due to fluctuations in hardware revenue, which is recognized upfront upon shipment, as opposed to most sales of software products for which revenue is recognized over time;
- Potential reductions in overall margins, as the gross margin for our hardware products is typically lower than those of our software products;
- Longer sales cycles, which create risks of insufficient, excess or obsolete inventory and variations in inventory valuation, which can adversely affect our operating results;
- Decreases or delays in customer purchases in favor of next-generation releases, which may lead to excess or obsolete inventory or require us to discount our older hardware products; and
- Longer warranty periods than those of our software products, which may require us to replace hardware components under warranty, thus increasing our costs.

Changes in United States Generally Accepted Accounting Principles (U.S. GAAP) could adversely affect our financial results and may require significant changes to our internal accounting systems and processes.

We prepare our consolidated financial statements in conformity with U.S. GAAP. These principles are subject to interpretation by the Financial Accounting Standards Board (FASB), the Securities and Exchange Commission (SEC) and various bodies formed to interpret and create appropriate accounting principles and guidance.

The FASB periodically issues new accounting standards on a variety of topics, including, for example, revenue recognition and accounting for leases. For information regarding new accounting standards, please refer to Note 14 of *Notes to Consolidated Financial Statements* under the heading "Effect of New Accounting Pronouncements." These and other such standards generally result in different accounting principles, which may significantly impact our reported results or could result in variability of our financial results. For example, the new revenue recognition standard became applicable to us at the beginning of fiscal 2019 and there is an increased volatility in our total revenue with less predictability than the prior accounting standard.

Our results could be adversely affected by a change in our effective tax rate as a result of tax law changes and related new or revised guidance and regulations, changes in our geographical earnings mix, unfavorable government reviews of our tax returns, material differences between our forecasted and actual annual effective tax rates, future changes to our tax structure, or by evolving enforcement practices.

Our operations are subject to income and transaction taxes in the United States and in multiple foreign jurisdictions, with a significant amount of our foreign earnings generated by our subsidiaries organized in Ireland and Hungary. Because we have a wide range of statutory tax rates in the multiple jurisdictions in which we operate, any changes in our geographical earnings mix, including those resulting from our intercompany transfer pricing or from changes in the rules governing transfer pricing, could materially impact our effective tax rate. Furthermore, a change in the tax law of the jurisdictions where we do business, including an increase in tax rates or an adverse change in the treatment of an item of income or expense, could result in a material increase in our tax expense and impact our financial position and cash flows.

On December 22, 2017, the President of the United States signed into law the Tax Cuts and Jobs Act (Tax Act), which significantly changed prior U.S. tax law and includes numerous provisions that affect our business. The Tax Act includes certain new provisions that began to affect our income from foreign operations in the first quarter of fiscal 2019. The applicability and impact of these new tax provisions is dependent in part on changes to our tax structure that were implemented in response to the Tax Act at the end of fiscal 2018. The net impact of such changes is uncertain, and could adversely affect our tax rate and cash flow in future years. Since the beginning of fiscal 2019, the U.S. Treasury Department has issued proposed regulations that, if finalized as written, would have a material impact on our ability to claim certain tax benefits related to the Tax Act. While the Company continues to evaluate the potential impact on its estimated annual tax rate, certain of these regulations have not been finalized and are subject to change. As additional regulations and guidance evolve with respect to the Tax Act, and as we gather more information and perform more analysis, our results may materially differ from previous estimates, and those differences may materially affect our financial position. Accounting for certain of these provisions requires the exercise of significant judgment. As regulations and guidance evolve with respect to the Tax Act, and as we gather more information and perform more analysis, our results may materially differ from previous estimates, and those differences may materially affect our financial position.

Further changes in the tax laws of foreign jurisdictions could arise as a result of the base erosion and profit shifting (BEPS) project undertaken by the Organisation for Economic Co-operation and Development (OECD), which represents a coalition of member countries. On October 5, 2015, the OECD issued a series of reports recommending changes to numerous long-standing tax principles. Many of these recommendations are being adopted by various countries in which we do business and may increase our taxes in these countries. Changes to these and other areas in relation to international tax reform, including future actions taken by foreign governments in response to the Tax Act, could increase uncertainty and may adversely affect our tax rate and cash flow in future years.

Our income and non-income tax filings are subject to review or audit by the Internal Revenue Service and state, local and foreign taxing authorities. We exercise significant judgment in determining our worldwide provision for income taxes and, in the ordinary course of our business, there may be transactions and calculations where the ultimate tax determination is uncertain. We may also be liable for potential tax liabilities of businesses we acquire, including future taxes payable related to the transition tax on earnings from their foreign operations, if any, under the Tax Act. Although we believe our tax estimates are reasonable, the final determination in an audit may be materially different than the treatment reflected in our historical income tax provisions and accruals. An assessment of additional taxes because of an audit could adversely affect our income tax provision and net income in the periods for which that determination is made.

In July 2017, the Hungarian Tax Authority (HTA) issued a final assessment against our Hungarian subsidiary (Synopsys Hungary) for fiscal years 2011 through 2013. The HTA has applied withholding taxes on certain payments made to affiliates, resulting in an aggregate tax assessment of approximately \$25.0 million and interest and penalties of \$11.0 million. We paid the tax assessments, penalties and interest in the first quarter of fiscal 2018 as required by law and recorded these amounts as prepaid taxes on our balance sheet. On April 30, 2019, the Hungarian Administrative Court ruled against Synopsys Hungary. We filed an appeal with the Hungarian Supreme Court on July 5, 2019. For further discussion of the Hungary audit, see Note 11 of *Notes to Consolidated Financial Statements* under the heading "Non-U.S. Examinations."

We maintain significant deferred tax assets related to certain tax credits. Our ability to use these credits is dependent upon having sufficient future taxable income in the relevant jurisdiction and in the case of foreign tax credits, how such credits are treated under provisions of the Tax Act. Changes in our forecasts of future income could result in an adjustment to the deferred tax asset and a related charge to earnings that could materially affect our financial results.

Liquidity requirements in our U.S. operations may require us to raise cash in uncertain capital markets, which could negatively affect our financial condition.

As of October 31, 2019, approximately 74% of our worldwide cash and cash equivalents balance is held by our international subsidiaries. We intend to meet our U.S. cash spending needs, including the Tax Act provisional transition tax, primarily through our existing U.S. cash balances, ongoing U.S. cash flows, and available credit under our term loan and revolving credit facilities. Should our cash spending needs in the U.S. rise and exceed these liquidity sources, we may be required to incur additional debt at higher than anticipated interest rates or access other funding sources, which could negatively affect our results of operations, capital structure or the market price of our common stock.

From time to time we are subject to claims that our products infringe on third-party intellectual property rights.

We are from time to time subject to claims alleging our infringement of third-party intellectual property rights, including patent rights. Under our customer agreements and other license agreements, we agree in many cases to indemnify our customers if our products infringe a third party's intellectual property rights. Infringement claims can result in costly and time-consuming litigation, require us to enter into royalty arrangements, subject us to damages or injunctions restricting our sale of products, invalidate a patent or family of patents, require us to refund license fees to our customers or to forgo future payments or require us to redesign certain of our products, any one of which could harm our business and operating results.

For example, we were engaged in complex patent litigation with Mentor Graphics Corporation (Mentor) involving several actions in different forums. In June 2018, we settled all outstanding patent litigation with Mentor for a $65.0 million payment made in the third quarter of fiscal 2018 to Siemens, which acquired Mentor in March 2017. Further information regarding the lawsuits and settlement are contained in Part I, Item 3, *Legal Proceedings* and Note 7 of *Notes to Consolidated Financial Statements* under the heading "Legal Proceedings." In conjunction with the settlement, we also amended an existing interoperability agreement with Mentor to collaborate on a wide range of EDA products. The amendment includes a one-time termination charge between $0.0 and $25.0 million, payable to Mentor under certain conditions. In the event such conditions are met, the termination charge could have an adverse effect on our operating results.

We may be subject to litigation proceedings that could harm our business.

We may be subject to legal claims or regulatory matters involving stockholder, consumer, employment, customer, supplier, competition, and other issues on a global basis. Litigation is subject to inherent uncertainties, and unfavorable rulings could occur. An unfavorable ruling could include monetary damages or, in cases for which injunctive relief is sought, an injunction prohibiting us from manufacturing or selling one or more products. If we were to receive an unfavorable ruling on a matter, our business and results of operations could be materially harmed. Further information regarding certain of these matters is contained in Part I, Item 3, *Legal Proceedings.*

We may not be able to continue to obtain licenses to third-party software and intellectual property on reasonable terms or at all, which may disrupt our business and harm our financial results.

We license third-party software and other intellectual property for use in product research and development and, in several instances, for inclusion in our products. We also license third-party software, including the software of our competitors, to test the interoperability of our products with other industry products and in connection with our professional services. These licenses may need to be renegotiated or renewed from time to time, or we may need to obtain new licenses in the future. Third parties may stop adequately supporting or maintaining their technology, or they or their technology may be acquired by our competitors. If we are unable to obtain licenses to these third-party software and intellectual property on reasonable terms or at all, we may not be able to sell the affected products, our customers' use of the products may be interrupted, or our product development processes and professional services offerings may be disrupted, which could in turn harm our financial results, our customers, and our reputation.

The inclusion of third-party intellectual property in our products can also subject us and our customers to infringement claims. Although we seek to mitigate this risk contractually, we may not be able to sufficiently limit our potential liability. Regardless of outcome, infringement claims may require us to use significant resources and may divert management's attention.

Some of our products and technology, including those we acquire, may include software licensed under open source licenses. Some open source licenses could require us, under certain circumstances, to make available or grant licenses to any modifications or derivative works we create based on the open source software. Although we have tools and processes to monitor and restrict our use of open source software, the risks associated with open source usage may not be eliminated and may, if not properly addressed, result in unanticipated obligations that harm our business.

If we fail to timely recruit and retain senior management and key employees, our business may be harmed.

We depend in large part upon the services of key members of our senior management team to drive our future success. If we were to lose the services of any member of our senior management team, our business could be adversely affected. To be successful, we must also attract and retain key technical, sales and managerial employees, including those who join us in connection with acquisitions. There are a limited number of qualified EDA and IC design engineers, and competition for these individuals is intense and has increased. Our employees are often recruited aggressively by our competitors and our customers. Any failure to recruit and retain key technical, sales and managerial employees could harm our business, results of operations and financial condition. Additionally, efforts to recruit and retain qualified employees could be costly and negatively impact our operating expenses.

We issue equity awards from employee equity plans as a key component of our overall compensation. We face pressure to limit the use of such equity-based compensation due to its dilutive effect on stockholders. If we are unable to grant attractive equity-based packages in the future, it could limit our ability to attract and retain key employees.

Our business is subject to evolving corporate governance and public disclosure regulations that have increased both our compliance costs and the risk of noncompliance, which could have an adverse effect on our stock price.

We are subject to changing rules and regulations promulgated by a number of governmental and self-regulatory organizations, including the SEC, the Nasdaq Stock Market, and the FASB. These rules and regulations continue to evolve in scope and complexity and many new requirements have been created in response to laws enacted by Congress, making compliance more difficult and uncertain. For example, our efforts to comply with the Dodd-Frank Wall Street Reform and Consumer Protection Act and other regulations, including "conflict minerals" regulations affecting our hardware products, have resulted in, and are likely to continue to result in, increased general and administrative expenses and a diversion of management time and attention from revenue-generating activities to compliance activities.

There are inherent limitations on the effectiveness of our controls and compliance programs.

Regardless of how well designed and operated it is, a control system can provide only reasonable assurance that its objectives will be met. Further, the design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, have been detected. Moreover, although we have implemented compliance programs and compliance training for employees, such measures may not prevent our employees, contractors or agents from breaching or circumventing our policies or violating applicable laws and regulations. Failure of our control systems and compliance programs to prevent error, fraud or violations of law could have a material adverse impact on our business.

Our investment portfolio may be impaired by any deterioration of capital markets.

From time to time, our cash equivalent and short-term investment portfolio consists of investment-grade U.S. government agency securities, asset-backed securities, corporate debt securities, commercial paper, certificates of deposit, money market funds, municipal securities and other securities, and bank deposits. Our investment portfolio carries both interest rate risk and credit risk. Fixed rate debt securities may have their market value adversely impacted due to a credit downgrade or a rise in interest rates, while floating rate securities may produce less income than expected if interest rates fall or a credit downgrade occurs. As a result of capital pressures on certain banks, especially in Europe, and the continuing low interest rate environment, some of our financial instruments may become impaired.

Our future investment income may fall short of expectations due to changes in interest rates or if the decline in fair value of investments held by us is judged to be other-than-temporary. In addition, we may suffer losses in principal if we are forced to sell securities that decline in market value due to changes in the issuer's credit quality or changes in interest rates.

In preparing our financial statements we make certain assumptions, judgments and estimates that affect amounts reported in our consolidated financial statements, which, if not accurate, may significantly impact our financial results.

We make assumptions, judgments and estimates for a number of items, including the fair value of financial instruments, goodwill, long-lived assets and other intangible assets, the realizability of deferred tax assets, the recognition of revenue and the fair value of stock awards. We also make assumptions, judgments and estimates in determining the accruals for employee-related liabilities, including commissions and variable compensation, and in determining the accruals for uncertain tax positions, valuation allowances on deferred tax assets, allowances for doubtful accounts, and legal contingencies. These assumptions, judgments and estimates are drawn from historical experience and various other factors that we believe are reasonable under the circumstances as of the date of the consolidated financial statements. Actual results could differ materially from our estimates, and such differences could significantly impact our financial results.

Catastrophic events may disrupt our business and harm our operating results.

Due to the global nature of our business, our operating results may be negatively impacted by catastrophic events throughout the world. We rely on a global network of infrastructure applications, enterprise applications and technology systems for our development, marketing, operational, support and sales activities. A disruption or failure of these systems in the event of a major earthquake, fire, telecommunications failure, cybersecurity attack, terrorist attack, epidemic, or other catastrophic event could cause system interruptions, delays in our product development and loss of critical data and could prevent us from fulfilling our customers' orders. Moreover, our corporate headquarters, a significant portion of our research and development activities, our data centers, and certain other critical business operations are located in California, near major earthquake faults. A catastrophic event that results in the destruction or disruption of our data centers or our critical business or information technology systems would severely affect our ability to conduct normal business operations and, as a result, our operating results would be adversely affected.

Item 1B. *Unresolved Staff Comments*

None.

Item 2. *Properties*

Our principal offices are located in two adjacent buildings in Mountain View, California, which together provide approximately 341,000 square feet of available space. This space is leased through August 2030, and we have two options to extend the lease term, the first to extend the term by ten years, followed by a second option to extend by approximately nine additional years. We also lease approximately 238,000 square feet of space in three separate buildings in Sunnyvale, California, with lease expirations ranging from December 2019 through June 2020.

Additionally, we own one building in Sunnyvale, California with approximately 120,000 square feet of space that will be vacated and leased to a third party in 2020 under a lease agreement that runs through February 2031. We will vacate these four Sunnyvale buildings between November 2019 and February 2020, and move into three separate buildings comprising approximately 350,000 square feet of space in Sunnyvale, California, which we have leased through October 2031. These buildings in Mountain View and Sunnyvale are used for research and development, sales and support, marketing, and administrative activities for both of our business segments.

We currently lease 31 other offices throughout the United States, and own two office buildings in Oregon, one of which is leased to a tenant. These offices are used primarily for sales and support activities as well as research and development for both of our business segments.

International Facilities

We lease additional space for sales, service, and research and development activities for both of our business segments in approximately 29 countries throughout the world, including 25,000 square feet in Dublin, Ireland for our international headquarters, as well as significant sites in Yerevan, Armenia, Bangalore, India, Shanghai and Wuhan. In addition, we own two buildings in Hsinchu with approximately 212,000 square feet of combined space.

We believe that our existing facilities, including both owned and leased properties, are in good condition and suitable for the current conduct of our business.

Item 3. *Legal Proceedings*

We are subject to routine legal proceedings, as well as demands, claims and threatened litigation that arise in the normal course of our business. The ultimate outcome of any litigation is often uncertain and unfavorable outcomes could have a negative impact on our results of operations and financial condition. Regardless of outcome, litigation can have an adverse impact on Synopsys because of the defense costs, diversion of management resources and other factors.

We regularly review the status of each significant matter and assess its potential financial exposure. If the potential loss from any claim or legal proceeding is considered probable and the amount is estimable, we accrue a liability for the estimated loss. Legal proceedings are inherently uncertain and as circumstances change, it is possible that the amount of any accrued liability may increase, decrease, or be eliminated.

Mentor Patent Litigation

Prior to the legal settlement as further described below, we were engaged in complex patent litigation with Mentor Graphics Corporation (Mentor) involving several actions in different forums. We succeeded to the litigation when we acquired Emulation & Verification Engineering S.A. on October 4, 2012.

Legal Settlement

In March 2017, Siemens PLM Software (Siemens) acquired Mentor. On June 29, 2018, Synopsys, Siemens and Mentor settled all outstanding patent litigation between Synopsys and Mentor for a $65.0 million payment made in the third quarter from Synopsys to Mentor. Synopsys had previously accrued $39.0 million and recorded the remaining $26.0 million as an expense in the quarter ended July 31, 2018. As a result of the settlement, the litigation with Mentor was dismissed and the injunction entered in connection with that litigation was vacated.

The settlement included mutual seven-year patent cross-licenses between Synopsys and Siemens, and between Synopsys and Mentor. Synopsys and Mentor also amended an existing interoperability agreement to collaborate on a wide range of EDA products for the benefit of their mutual customers. The amendment includes a one-time termination charge between $0.0 and $25.0 million, payable to Mentor under certain conditions.

Other Proceedings

In July 2017, the HTA issued a final assessment against Synopsys' Hungarian subsidiary (Synopsys Hungary) for fiscal years 2011 through 2013. The HTA has disallowed Synopsys Hungary's tax positions taken during these years regarding the timing of the deduction of research expenses and applied withholding taxes on certain payments made to affiliates, resulting in an aggregate tax assessment of approximately $44.5 million and interest and penalties of $18.0 million. On August 2, 2017, Synopsys Hungary filed a claim contesting the final assessment with the Hungarian Administrative Court. On November 16, 2017, Synopsys Hungary paid the assessment as required by law, while continuing its challenge to the assessment in court. Hearings were held in February and July 2018, February 26, 2019 and April 30, 2019. On December 10, 2018, Synopsys withdrew its claim contesting the final assessment with regard to the timing of the deduction of research expenses, resulting in a remaining disputed tax assessment of approximately $25.0 million and interest and penalties of $11.0 million. On April 30, 2019, the Hungarian Administrative Court (Court) ruled against Synopsys Hungary. The Court's opinion was received on May 16, 2019. Synopsys Hungary filed an appeal with the Hungarian Supreme Court on July 5, 2019. In the second quarter of 2019, as a result of the Court's decision, the Company recorded a tax expense due to an unrecognized tax benefit of $17.4 million, which is net of estimated U.S. foreign tax credits for the tax assessments.

For further discussion of the Hungary audit, see Note 11 of *Notes to Consolidated Financial Statements* under the heading "Non-U.S. Examinations."

Item 4. *Mine Safety Disclosures*

Not applicable.

PART II

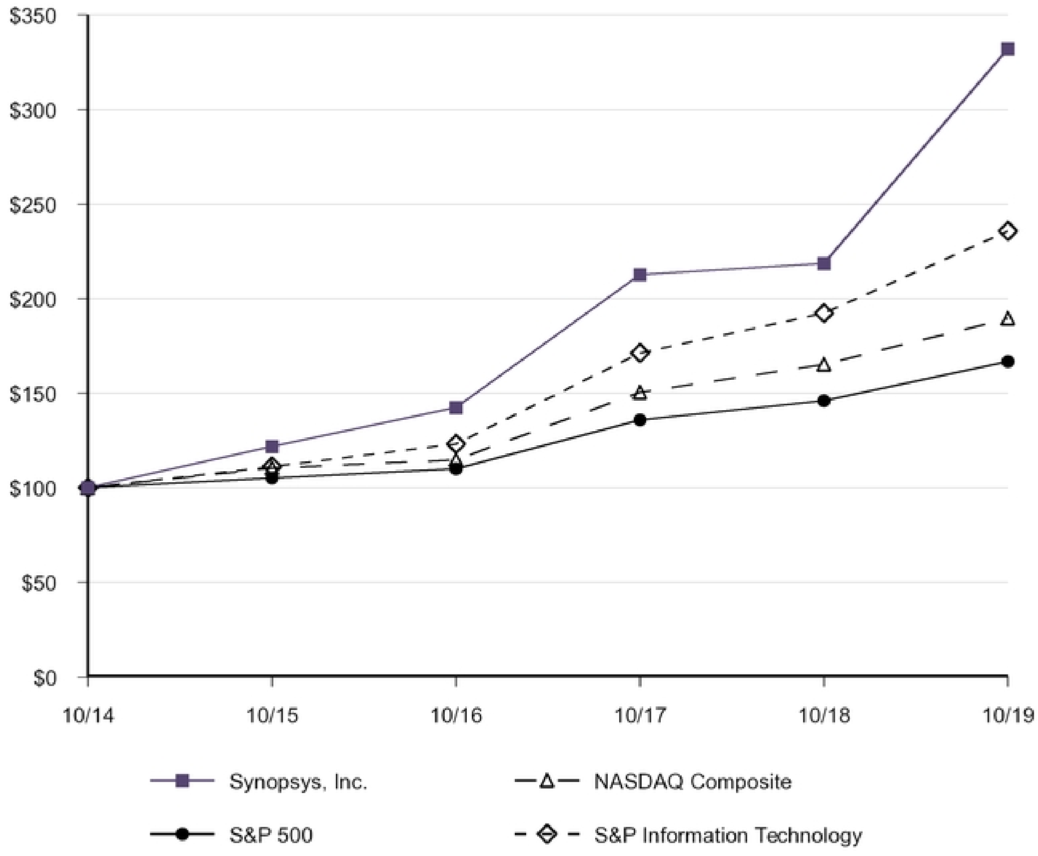
Item 5. *Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities*

Our common stock trades on the Nasdaq Global Select Market under the symbol "SNPS." As of December 13, 2019, we had 260 stockholders of record.

Performance Graph

The following graph compares the five-year total return to stockholders of our common stock relative to the cumulative total returns of the S&P 500 Index, the S&P Information Technology Index and the Nasdaq Composite Index. The graph assumes that $100 was invested in Synopsys common stock on October 31, 2014 (the last trading day before the beginning of our fifth preceding fiscal year) and in each of the indexes on October 31, 2014 (the closest month end) and that all dividends were reinvested. No cash dividends were declared on our common stock during such time. The comparisons in the table are not intended to forecast or be indicative of possible future performance of our common stock.

COMPARISON OF 5 YEAR CUMULATIVE TOTAL RETURN*



*$100 invested on October 31, 2014 in stock or index, including reinvestment of dividends.

The information presented above in the stock performance graph shall not be deemed to be “soliciting material” or to be “filed” with the SEC or subject to Regulation 14A or 14C, except to the extent that we subsequently specifically request that such information be treated as soliciting material or specifically incorporate it by reference into a filing under the Securities Act or Exchange Act.

Stock Repurchase Program

Our Board of Directors (Board) previously approved a stock repurchase program pursuant to which we were authorized to purchase up to $500.0 million of our common stock, and has periodically replenished the stock repurchase program to such amount. Our Board replenished the stock repurchase program up to $500.0 million on June 14, 2019. The program does not obligate us to acquire any particular amount of common stock, and the program may be suspended or terminated at any time by our Chief Financial Officer or our Board. We repurchase shares to offset dilution caused by ongoing stock issuances from existing equity plans for equity compensation awards and issuances related to acquisitions, and when management believes it is a good use of cash. Repurchases are transacted in accordance with Rule 10b-18 of the Securities Exchange Act of 1934, as amended (the Exchange Act) and may be made through any means including, but not limited to, open market purchases, plans executed under Rule 10b5-1(c) of the Exchange Act and structured transactions. As of October 31, 2019, $400.0 million remained available for further repurchases under the program.

In December 2017, we entered into two simultaneous accelerated share repurchase agreements (the December 2017 ASRs) to repurchase an aggregate of $200.0 million of our common stock. Pursuant to the December 2017 ASRs, we made a prepayment of $200.0 million and received initial share deliveries of shares valued at $160.0 million. In February 2018, we received additional deliveries of shares valued at $20.0 million for one of the two December 2017 ASRs. The remaining balance of $20.0 million was settled in March 2018. Total shares repurchased under the December 2017 ASRs were approximately 2.3 million shares, at an average purchase price of $87.08 per share.

In May 2018, we entered into an accelerated share repurchase agreement (the May 2018 ASR) to repurchase an aggregate of $165.0 million of our common stock. Pursuant to the May 2018 ASR, we made a prepayment of $165.0 million and received initial share deliveries valued at $132.0 million. The remaining balance of $33.0 million was settled in October 2018. Total shares repurchased under the May 2018 ASR were approximately 1.8 million shares, at an average purchase price of $92.42 per share.

In February 2019, we entered into an accelerated share repurchase agreement (the February 2019 ASR) to repurchase an aggregate of $100.0 million of our common stock. Pursuant to the February 2019 ASR, we made a prepayment of $100.0 million and received initial share deliveries valued at $80.0 million. The remaining balance of $20.0 million was settled in May 2019. Total shares repurchased under the February 2019 ASR were approximately 0.9 million shares, at an average purchase price of $114.01 per share.

In June 2019, we entered into an accelerated share repurchase agreement (the June 2019 ASR) to repurchase an aggregate of $100.0 million of our common stock. Pursuant to the June 2019 ASR, we made a prepayment of $100.0 million and received initial share deliveries valued at $80.0 million. The remaining balance of $20.0 million was settled in August 2019. Total shares repurchased under the June 2019 ASR were approximately 0.8 million shares, at an average purchase price of $130.23 per share.

In August 2019, we entered into an accelerated share repurchase agreement (the August 2019 ASR) to repurchase an aggregate of $100.0 million of our common stock. Pursuant to the August 2019 ASR, we made a prepayment of $100.0 million and received initial share deliveries valued at $80.0 million. The remaining balance of $20.0 million was settled in October 2019. Total shares repurchased under the August 2019 ASR were approximately 0.7 million shares, at an average purchase price of $134.99 per share.

In December 2019, we entered an accelerated share repurchase agreements (the December 2019 ASR) to repurchase an aggregate of $100.0 million of our common stock. Pursuant to the December 2019 ASR, we will make a prepayment of $100.0 million to receive initial share deliveries of shares valued at $80.0 million. The remaining balance of $20.0 million is anticipated to be settled on or before February 27, 2020, upon completion of the repurchase. Under the terms of the December 2019 ASR, the specific number of shares that we ultimately repurchase will be based on the volume-weighted average share price of our common stock during the repurchase period, less a discount.

The table below sets forth information regarding our repurchases of our common stock during the three months ended October 31, 2019:

Period	Total number of shares purchased (1)		Average price paid per share (1)	Total number of shares purchased as part of publicly announced programs		Maximum dollar value of shares that may yet be purchased under the programs
Month #1						
August 4, 2019 through September 7, 2019	675,211	$	148.10	675,211	$	400,000,000
Month #2						
September 8, 2019 through October 5, 2019	—	$	—	—	$	400,000,000
Month #3						
October 6, 2019 through November 2, 2019	155,808	$	128.36	155,808	$	400,000,000
Total	831,019	$	144.40	831,019	$	400,000,000

(1) Amounts are calculated based on the settlement date.

Item 6. *Selected Financial Data*

	Fiscal Year Ended October 31,(1)				
	2019	2018	2017	2016	2015
	(in thousands, except per share data)				
Revenue	$ 3,360,694	$ 3,121,058	$ 2,724,880	$ 2,422,532	$ 2,242,211
Income before provisions for income taxes	545,506	363,543	383,098	329,548	281,610
Provision (benefit) for income taxes(2)	13,139	(68,975)	246,535	62,722	55,676
Net income	532,367	432,518	136,563	266,826	225,934
Net income per share:					
Basic	3.55	2.90	0.91	1.76	1.46
Diluted	3.45	2.82	0.88	1.73	1.43
Working capital (deficit)(3)	(13,536)	(558,618)	68,484	1,992	(109,546)
Total assets	6,405,160	6,145,974	5,396,414	5,240,365	5,045,739
Long-term debt	120,093	125,535	134,063	—	—
Stockholders' equity	4,088,876	3,485,015	3,279,724	3,195,146	3,133,989

(1) Our fiscal year ends on the Saturday nearest to October 31 and consists of 52 weeks, with the exception that approximately every five years, we have a 53-week year. When a 53-week year occurs, we include the additional week in the first quarter to realign fiscal quarters with calendar quarters. Fiscal 2018 was a 53-week year and ended on November 3, 2018. Fiscal 2019, 2017, 2016, and 2015 were 52-week years ending on November 2, 2019, October 28, 2017, October 29, 2016, and October 31, 2015, respectively.

(2) Includes $10.9 million, $14.7 million, $7.1 million, $16.5 million, and $6.3 million in net tax benefits from tax settlements received in fiscal 2019, 2018, 2017, 2016, and 2015, respectively. Fiscal 2018 additionally includes a $57.8 million net benefit from tax reform and tax restructuring. Fiscal 2017 additionally includes a $166.2 million expense from our repatriation of foreign earnings. See Note 11 of *Notes to Consolidated Financial Statements*.

(3) Includes reclassifications of deferred tax assets and liabilities for fiscal year 2015 related to ASU 2015-17 “Income Taxes (Topic 740): Balance Sheet Classification of Deferred Taxes.” See Note 11 of *Notes to Consolidated Financial Statements*.

Item 7. *Management's Discussion and Analysis of Financial Condition and Results of Operations*

Overview

The following overview of our financial condition and results of operations is qualified in its entirety by the more complete discussion contained in this Item 7, the risk factors set forth in Item 1A of this Form 10-K and our consolidated financial statements and the notes thereto set forth in Item 8 of this Form 10-K. Please also see the cautionary language at the beginning of Part I of this Form 10-K regarding forward-looking statements.

Business Summary

Synopsys, Inc. provides products and services used across the entire silicon to software spectrum, from engineers creating advanced semiconductors to software developers seeking to ensure the security and quality of their code. We are a global leader in supplying the electronic design automation (EDA) software that engineers use to design and test integrated circuits (ICs), also known as chips. We also offer semiconductor intellectual property (IP) products, which are pre-designed circuits that engineers use as components of larger chip designs rather than designing those circuits themselves. We provide software and hardware used to validate the electronic systems that incorporate chips and the software that runs on them. To complement these offerings, we provide technical services and support to help our customers develop advanced chips and electronic systems. These products and services are part of our Semiconductor & System Design segment.

We are also a leading provider of software tools and services that improve the security and quality of software code in a wide variety of industries, including electronics, financial services, media, automotive, medicine, energy and industrials. These tools and services are part of our Software Integrity segment.

Our EDA and IP customers are generally semiconductor and electronics systems companies. Our solutions help these companies overcome the challenges of developing increasingly advanced electronics products while also helping them reduce their design and manufacturing costs. While our products are an important part of our customers' development process, our sales could be affected based on their research and development budgets, and our customers' spending decisions may be affected by their business outlook and willingness to invest in new and increasingly complex chip designs.

Our Software Integrity business delivers products and services that enable software developers to test their code - while it is being written - for known security vulnerabilities and quality defects, as well as testing for open source security vulnerabilities and license compliance. Our Software Integrity customers are software developers across many industries, including, but also well beyond, the semiconductor and systems industries. Our Software Integrity products and services form a platform that helps our customers build security into the software development lifecycle and across the entire cyber supply chain.

Despite global economic uncertainty, we have consistently grown our revenue since 2005. We achieved these results because of our solid execution, leading technologies and strong customer relationships. We recognize our revenue for the software licenses over the arrangement period, which typically approximates three years. For discussion on our revenue recognition policy, please see Note 2 of *Notes to Consolidated Financial Statements.* Time-based revenue consists of time-based products, maintenance and service revenue. The revenue we recognize in a particular period generally results from selling efforts in prior periods rather than the current period. As a result, decreases as well as increases in customer spending do not immediately affect our revenues in a significant way.

Our growth strategy is based on building on our leadership in our EDA products, expanding and proliferating our IP offerings, and driving growth in the software security and quality market. As we continue to expand our product portfolio and our total addressable market, for instance in the software security and quality space, and as hardware product sales grow, we expect to experience increased variability in our total revenue. In addition, due to our adoption of Accounting Standard Codification 606 (ASC 606), "Revenue from Contracts with Customers", in the beginning of fiscal 2019, as further described in Note 2 of *Notes to Consolidated Financial Statements*, the way in which we are required to account for certain types of arrangements has increased the variability in our total revenue from period to period. Nevertheless, the accounting impact has not affected our cash generated from our business. Based on our leading technologies, customer relationships, business model, diligent expense management, and acquisition strategy, we believe that we will continue to execute our strategies successfully.

Business Segments

Effective in fiscal 2019, we realigned our business to evaluate the results of our Software Integrity business separately from our traditional EDA and semiconductor IP business. The Chief Operating Decision Makers (CODMs) now regularly review disaggregated information for the following two reportable segments: (1) Semiconductor & System Design, which includes EDA tools, IP products, system integration solutions and other revenue categories, and (2) Software Integrity, which includes a comprehensive solution for building integrity—security, quality and compliance testing—into our customers' software development lifecycle and supply chain. Our historical results have been recast to retrospectively reflect the change from one to two reportable segments.

As a result of the change in reporting structure, financial information provided to and used by the CODMs to assist in making operational decisions, allocating resources and assessing performance reflects consolidated financial information as well as revenue, adjusted operating income, and adjusted operating margin for the Semiconductor & System Design and Software Integrity segments, accompanied by disaggregated information relating to revenues by geographic region.

Semiconductor & System Design. This segment includes our advanced silicon design, verification products and services, and semiconductor IP portfolio, which encompasses products and services that serve companies primarily in the semiconductor and electronics industries. EDA includes digital, custom IC design and Field Programmable Gate Array (FPGA) design software, verification products, and manufacturing software products. Designers use these products to automate the IC design process and to reduce errors. For IP, we are a leading provider of high-quality, silicon-proven IP solutions for system-on-chips (SoCs). This includes IP that has been optimized to address specific application requirements for the mobile, automotive, digital home, internet of things, and cloud computing markets, enabling designers to quickly develop SoCs in these areas.

Software Integrity. This segment includes a broad portfolio of products and services such as leading quality testing technologies, automated analysis, and consulting experts. Beginning in fiscal 2019, we launched the Polaris Software Integrity Platform™, an integrated cloud-based solution that unites key elements to provide an even more valuable way for developers to better develop personalized approaches for open source license compliance and detect and remediate known security vulnerabilities and quality defects early in the development process, thereby minimizing risk and maximizing productivity.

Fiscal Year End

Our fiscal year ends on the Saturday nearest to October 31 and consists of 52 weeks, with the exception that approximately every five years, we have a 53-week year. When a 53-week year occurs, we include the additional week in the first quarter to realign fiscal quarters with calendar quarters. Fiscal 2018 was a 53-week year and ended on November 3, 2018. Fiscal 2019 and 2017 were 52-week years ending on November 2, 2019 and October 28, 2017, respectively. Fiscal 2020 will be a 52-week year.

For presentation purposes, this Form 10-K refers to the closest calendar month end.

Fiscal 2019 Financial Performance Summary

We adopted new revenue guidance, ASC 606, at the beginning of fiscal 2019 under the modified retrospective method which has limited the comparability of prior year results in revenue and commission expense. The comparative information for periods prior to fiscal 2019 has not been restated. Additional comparative information is provided in Note 2 of the *Notes to Consolidated Financial Statements* for the adoption of ASC 606 and our pro-forma financial results under Accounting Standards Codification 605 (ASC 605), "Revenue Recognition", for fiscal 2019.

In fiscal 2019, compared to fiscal 2018, our financial performance reflects the following:

- Revenues were $3.4 billion, an increase of $239.6 million or 8%, primarily due to our continued growth organically, as well as the adoption of ASC 606, partially offset by additional revenue of approximately $46.0 million due to the extra week in fiscal 2018;
- Total cost of revenue and operating expenses were $2.8 billion, an increase of $79.6 million or 3%, primarily due to increases in restructuring costs of $34.2 million and employee-related costs of $81.3 million, resulting from increases in headcount, partially offset by a litigation settlement in fiscal 2018 of $26.0 million and a legal settlement in our favor in fiscal 2019 of $18.3 million;
- Operating income of $520.2 million, an increase of $160.0 million or 44%.

Critical Accounting Policies and Estimates

Our discussion and analysis of our financial results under *Results of Operations* below are based on our audited results of operations, which we have prepared in accordance with U.S. GAAP. In preparing these financial statements, we make assumptions, judgments and estimates that can affect the reported amounts of assets, liabilities, revenues and expenses, and net income. On an ongoing basis, we evaluate our estimates based on historical experience and various other assumptions we believe are reasonable under the circumstances. Our actual results may differ from these estimates. See Note 2 of *Notes to Consolidated Financial Statements* for further information on our significant accounting policies.

The accounting policies that most frequently require us to make assumptions, judgments and estimates, and therefore are critical to understanding our results of operations, are:

- Revenue recognition;
- Valuation of business combinations; and
- Income taxes.

Revenue Recognition

Our contracts with customers often include promises to transfer multiple products and services to a customer. Determining whether services and products are considered distinct performance obligations that should be accounted for separately versus together may require significant judgment. We have concluded that our EDA software licenses in TSL contracts are not distinct from our obligation to provide unspecified software updates to the licensed software throughout the license term, because those promises represent inputs to a single, combined performance obligation. Where unspecified additional software product rights are part of the contract with the customer, those rights are accounted for as part of the single performance obligation that includes the licenses, updates, and technical support, because such rights are provided during the same period of time and have the same time-based pattern of transfer to the customer. In reaching this conclusion, we considered the nature of our obligation to customers which is to provide an ongoing right to use the most up to date and relevant software. As EDA customers operate in a rapidly changing and competitive environment, satisfying the obligation requires providing critical updates to the existing software products, including ongoing iterative interaction with customers to make the software relevant to the customers’ ability to meet the time to go to market with advanced products.

Business Combinations

We allocate the purchase price of acquired companies to the tangible and intangible assets acquired and liabilities assumed based upon their estimated fair values at the acquisition date. The purchase price allocation process requires management to make significant estimates and assumptions with respect to intangible assets. Although we believe the assumptions and estimates we have made are reasonable, they are based in part on historical experience, market conditions and information obtained from management of the acquired companies and are inherently uncertain. Examples of critical estimates in valuing certain of the intangible assets we have acquired or may acquire in the future include, but are not limited to:

- future expected cash flows from software license sales, subscriptions, support agreements, consulting contracts and acquired developed technologies and patents;
- historical and expected customer attrition rates and anticipated growth in revenue from acquired customers;
- the expected use of the acquired assets; and
- discount rates.

Unanticipated events and circumstances may occur which may affect the accuracy or validity of such assumptions, estimates or actual results.

Income Taxes

We use the asset and liability method of accounting for income taxes. Under this method, income tax expense is recognized for the amount of taxes payable or refundable for the current year. In addition, deferred tax assets and liabilities are recognized for the expected future tax consequences of temporary differences between the financial reporting and tax bases of assets and liabilities, and for operating losses and tax credit carryforwards. Management must make assumptions, judgments and estimates to determine our current provision for income taxes and also our deferred tax assets and liabilities.

Our assumptions, judgments and estimates relative to the current provision for income taxes take into account current tax laws, our interpretation of current tax laws and possible outcomes of current and future audits conducted by foreign and domestic tax authorities. We have established reserves for income taxes to address potential exposures involving tax positions that could be challenged by tax authorities. In addition, we are subject to the continual examination of our income tax returns by the U.S. Internal Revenue Service (IRS) and other domestic and foreign tax authorities. We regularly assess the likelihood of outcomes resulting from these examinations to determine the adequacy of our provision for income taxes and have reserved for potential adjustments that may result from such examinations. We believe such estimates to be reasonable; however, the final determination of any of these examinations could significantly impact the amounts provided for income taxes in our consolidated financial statements.

Effect of New Accounting Pronouncements Not Yet Adopted

See Note 14 of *Notes to Consolidated Financial Statements.*

Results of Operations

We adopted new revenue guidance, ASC 606, at the beginning of fiscal 2019 under the modified retrospective method which has limited the comparability of prior year results in revenue and commission expense. The comparative information for periods prior to the fiscal 2019 has not been restated. Additional comparative information is provided in Note 2 of the *Notes to Consolidated Financial Statements* for the adoption of ASC 606 and our pro-forma financial results under ASC 605 for fiscal 2019.

Revenue

Our revenues are generated from two business segments: the Semiconductor & System Design segment and the Software Integrity segment. See Note 13 of the *Notes to Consolidated Financial Statements* for additional information about our reportable segments and revenue by geographic regions.

Further disaggregation of the revenues into various products and services within these two segments is summarized as follows:

Semiconductor & System Design Segment

This segment is comprised of the following:

- EDA software includes digital, custom and Field Programmable Gate Array (FPGA) IC design software, verification products and obligations to provide unspecified updates and support services. EDA products and services are typically sold through TSL arrangements that grant customers the right to access and use all of the licensed products at the outset of an arrangement and software updates are generally made available throughout the entire term of the arrangement. The weighted-average term of the TSLs we entered into in fiscal 2019, 2018, and 2017 were all 2.7 years, respectively. Under ASC 606, we have concluded that the software licenses in TSL contracts are not distinct from the obligation to provide unspecified software updates to the licensed software throughout the license term, because the multiple software licenses represent inputs to a single, combined offering, and timely, relevant software updates are integral to maintaining the utility of the software licenses. We recognize revenue for the combined performance obligation under TSL contracts ratably over the term of the license. Under ASC 605, these arrangements were previously recognized ratably over the contract term.

- IP & System Integration includes our DesignWare® IP portfolio and system-level products and services. Under ASC 606, these arrangements generally have two performance obligations which consist of transferring of the licensed IP and providing related support, which includes rights to technical support and software updates that are provided over the support term and are transferred to the customer over a time. Revenue allocated to the IP licenses is recognized at a point in time upon the later of the delivery date or the beginning of the license period, and revenue allocated to support is recognized over the support term. Royalties are recognized as revenue in the quarter in which the applicable customer sells its products that incorporate our IP. Payments for IP contracts are generally received upon delivery of the IP. Revenue related to the customization of certain IP is recognized as "Professional Services." Under ASC 605, we previously recognized revenues ratably for certain IP licensing and support arrangements.

- In the case of arrangements involving the sale of Hardware products, we generally have two performance obligations. The first performance obligation is to transfer the hardware product, which includes software integral to the functionality of the hardware product. The second performance obligation is to provide maintenance on the hardware and its embedded software, which includes rights to technical support, hardware repairs and software updates that are all provided over the same term and have the same time-based pattern of transfer to the customer. The portion of the transaction price allocated to the hardware product is generally recognized as revenue at the time of delivery because the customer obtains control of the product at that point in time. We have concluded that control generally transfers at that point in time because the customer has title to the hardware, physical possession, and a present obligation to pay for the hardware. The portion of the transaction price allocated to the maintenance obligation is recognized as revenue ratably over the maintenance term. The adoption of ASC 606 did not change the timing of revenue recognition for hardware products.

- Revenue from Professional Service contracts is recognized over time, generally using costs incurred or hours expended to measure progress. We have a history of reasonably estimating project status and the costs necessary to complete projects. A number of internal and external factors can affect these estimates, including labor rates, utilization and efficiency variances and specification and testing requirement changes. The adoption of ASC 606 did not change from ASC 605 the timing of revenue recognition for professional services.

Software Integrity Segment

- We sell Software Integrity products in arrangements that provide customers the right to software licenses, maintenance updates and technical support. Over the term of these arrangements, the customer expects us to provide integral maintenance updates to the software licenses, which help customers protect their own software from new critical quality defects and potential security vulnerabilities. The licenses and maintenance updates serve together to fulfill our commitment to the customer as both work together to provide the functionality to the customer and represent a combined performance obligation. We will recognize revenue for the combined performance obligation over the term of the arrangement.

Most of our customer arrangements are complex, involving hundreds of products and various license rights, and our customers bargain with us over many aspects of these arrangements. For example, they often demand a broader portfolio of solutions, support and services and seek more favorable terms such as expanded license usage, future purchase rights and other unique rights at an overall lower total cost. No single factor typically drives our customers' buying decisions, and we compete on all fronts to serve customers in highly competitive markets. Customers generally negotiate the total value of the arrangement rather than just unit pricing or volumes.

Total Revenue

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Semiconductor & System Design Segment	$ 3,026.1	$ 2,840.6	$ 2,551.1	$ 185.5	7%	$ 289.5	11%
Software Integrity Segment	334.6	280.5	173.8	54.1	19%	106.7	61%
Total	$ 3,360.7	$ 3,121.1	$ 2,724.9	$ 239.6	8%	$ 396.2	15%

The overall growth of our business has been the primary driver of the increase in our revenue. Our revenues are subject to fluctuations, primarily due to customer requirements, including the timing and value of contract renewals, as well as payment terms for revenue recognized under ASC 605. For example, we experience variability in our revenue due to factors such as the timing of IP consulting projects, royalties, variability in IP products sales and hardware sales. As revenue from IP products sales and hardware sales are recognized upfront, customer demand and timing requirements for such IP products and hardware have resulted in increased variability of our total revenue.

The increase in total revenue for fiscal 2019 compared to fiscal 2018 was primarily attributable to the continued business growth in all product categories, and higher revenue of $102.5 million recognized under new revenue standard ASC 606 compared with revenue recognized under old revenue standard ASC 605. The increase was partially offset by approximately $46.0 million of additional revenue due to one extra week in fiscal 2018.

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The increase in total revenue for fiscal 2018 compared to fiscal 2017 was primarily attributable to the continued overall growth of our business, mainly due to higher TSL license revenue from arrangements booked in prior periods, an increase in professional services, additional revenue of approximately $46.0 million due to an extra week in the first quarter of fiscal 2018 compared to fiscal 2017, and contributions from acquired companies.

For a discussion of revenue by geographic areas, see Note 13 of *Notes to Consolidated Financial Statements.*

Time-Based Products Revenue

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
	$ 2,198.0	$ 2,303.3	$ 2,021.8	$ (105.3)	(5)%	$ 281.5	14%
Percentage of total revenue	65%	74%	74%				

The decrease in time-based products revenue for fiscal 2019 compared to fiscal 2018 was primarily attributable to the impact of lower revenue recognized under ASC 606 of $206.9 million offset by an increase in TSL license revenue from arrangements booked in prior periods.

The increase in time-based products revenue for fiscal 2018 compared to fiscal 2017 was primarily attributable to an increase in TSL license revenue due to arrangements booked in prior periods, including contributions from acquired companies, and additional revenue due to an extra week in fiscal 2018 compared to fiscal 2017.

Upfront Products Revenue

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
	$ 619.8	$ 357.7	$ 338.2	$ 262.1	73%	$ 19.5	6%
Percentage of total revenue	18%	11%	12%				

Changes in upfront products revenue are generally attributable to normal fluctuations in customer requirements, which can drive the amount of upfront orders and revenue in any particular period.

The increase in upfront products revenue for fiscal 2019 compared to fiscal 2018 was primarily due to an increase in the sale of IP products driven by higher demand from customers and higher IP revenue recognized upfront under ASC 606 of $235.4 million.

The increase in upfront products revenue for fiscal 2018 compared to fiscal 2017 was primarily attributable to an increase in the sale of IP products driven by higher demand from customers.

Upfront products revenue as a percentage of total revenue will likely fluctuate based on the timing of IP products and hardware sales. Such fluctuations will continue to be impacted by the timing of shipments due to customer requirements.

Maintenance and Service Revenue

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Maintenance revenue	$ 179.0	$ 100.4	$ 84.1	$ 78.6	78%	$ 16.3	19%
Professional service and other revenue	363.9	359.6	280.8	4.3	1%	78.8	28%
Total	$ 542.9	$ 460.0	$ 364.9	$ 82.9	18%	$ 95.1	26%
Percentage of total revenue	17%	15%	14%				

The increase in maintenance revenue for fiscal 2019 compared to fiscal 2018 was primarily due to higher revenue under ASC 606 of $74.0 million and an increase in the volume of arrangements that include maintenance.

The increase in maintenance revenue for fiscal 2018 compared to fiscal 2017 was primarily due to an increase in the volume of arrangements that include maintenance.

The increase in professional services and other revenue for fiscal 2019 compared to fiscal 2018 was primarily due to the timing of IP consulting projects. The increase was offset by the impact of the extra week in fiscal 2018.

The increase in professional services and other revenue for fiscal 2018 compared to fiscal 2017 was primarily due to an increase in consulting projects, including contributions from acquisitions, and to a lesser extent, the impact of the extra week in fiscal 2018.

Cost of Revenue and Operating Expenses

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Cost of revenue	$ 752.9	$ 735.9	$ 654.2	$ 17.0	2%	$ 81.7	12%
Operating expenses	2,087.5	2,024.9	1,723.1	62.6	3%	301.8	18%
Total	$ 2,840.4	$ 2,760.8	$ 2,377.3	$ 79.6	3%	$ 383.5	16%
Total expenses as a percentage of total revenue	85%	88%	87%				

Our expenses are generally impacted by changes in personnel-related costs including salaries, benefits, stock-based compensation and variable compensation; changes in amortization; and changes in selling and marketing expenses. The increase in our expenses compared to prior fiscal years was primarily due to an increase in personnel-related costs, driven by increased headcount from our overall growth, and fixed charges including information technology (IT) and facilities.

Foreign currency fluctuations, net of hedging, did not have a significant impact on expenses during fiscal 2019 as compared to fiscal 2018, or fiscal 2018 as compared to fiscal 2017. See Note 5 of *Notes to Consolidated Financial Statements* for details on our foreign exchange hedging programs.

Cost of Revenue

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Cost of products revenue	$ 459.1	$ 448.4	$ 413.2	$ 10.7	2 %	$ 35.2	9%
Cost of maintenance and service revenue	234.2	203.5	164.9	30.7	15 %	38.6	23%
Amortization of intangible assets	59.6	84.0	76.1	(24.4)	(29)%	7.9	10%
Total	$ 752.9	$ 735.9	$ 654.2	$ 17.0	2 %	$ 81.7	12%
Percentage of total revenue	22%	24%	24%				

We divide cost of revenue into three categories: cost of products revenue, cost of maintenance and service revenue, and amortization of intangible assets. We segregate expenses directly associated with consulting and training services from cost of products revenue associated with internal functions providing license delivery and post-customer contract support services. We then allocate these group costs between cost of products revenue and cost of maintenance and service revenue based on products and maintenance and service revenue reported.

Cost of products revenue. Cost of products revenue includes costs related to products sold and software licensed, allocated operating costs related to product support and distribution costs, royalties paid to third-party vendors, and the amortization of capitalized research and development costs associated with software products that had reached technological feasibility.

Cost of maintenance and service revenue. Cost of maintenance and service revenue includes operating costs related to maintaining the infrastructure necessary to operate our services and costs to deliver our consulting services, such as hotline and on-site support, production services and documentation of maintenance updates. We expect our cost of maintenance and service revenue to increase in future periods because of recent acquisitions, but we do not expect the impact to be material to our total cost of revenue.

Amortization of intangible assets. Amortization of intangible assets, which is recorded to cost of revenue and operating expenses, includes the amortization of core/developed technology, trademarks, trade names, customer relationships, covenants not to compete related to acquisitions and certain contract rights related to acquisitions.

The increase in cost of revenue for fiscal 2019 compared to fiscal 2018 was primarily due to an increase of $21.5 million in personnel-related costs as a result of headcount increases from organic hiring, $11.3 million in consulting costs primarily related to servicing IP consulting arrangements, $10.1 million in IT and facility expenses, and $5.3 million in depreciation and maintenance expenses, partially offset by a decrease of $24.4 million in amortization of intangible assets and one additional week of expenses of approximately $4.5 million in fiscal 2018.

The increase in cost of revenue for fiscal 2018 compared to fiscal 2017 was primarily due to an increase of $47.7 million in personnel-related costs as a result of headcount increases, including those from acquisitions, an increase of $11.3 million in costs related to servicing IP consulting arrangements, and an increase of $7.9 million in amortization of intangible assets, as well as one additional week of expenses of approximately $4.5 million in fiscal 2018.

Changes in other cost of revenue categories for the above-mentioned periods were not individually material.

Operating Expenses

Research and Development

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
	(dollars in millions)						
	$ 1,136.9	$ 1,084.8	$ 908.8	$ 52.1	5%	$ 176.0	19%
Percentage of total revenue	34%	35%	33%				

The increase in research and development expenses for fiscal 2019 compared to fiscal 2018 was primarily due to increases of $41.5 million in personnel-related costs as a result of headcount increases, including organic hiring and those from prior year acquisitions, $22.8 million in IT and facility expenses, and $5.5 million in consultants and contractor costs, partially offset by an additional week of expenses of approximately $19.3 million in fiscal 2018.

The increase in research and development expense for fiscal 2018 compared to fiscal 2017 was primarily due to an increase of $114.4 million in personnel-related costs as a result of headcount increases, including those from acquisitions, and one additional week of expenses of approximately $19.3 million in fiscal 2018.

Changes in other research and development expense categories for the above-mentioned periods were not individually material.

Sales and Marketing

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
	(dollars in millions)						
	$ 632.9	$ 623.0	$ 549.2	$ 9.9	2%	$ 73.8	13%
Percentage of total revenue	19%	20%	20%				

The increase in sales and marketing expenses for fiscal 2019 compared to fiscal 2018 was primarily due to increases of $11.3 million in personnel-related costs as a result of headcount increases and $4.3 million in IT and facility expenses, partially offset by an additional week of expenses of approximately $5.8 million in fiscal 2018.

For fiscal 2019, commission expenses were $4.1 million lower compared to commission expenses under ASC 605.

Changes in other sales and marketing expense categories for the above-mentioned periods were not individually material.

The increase in sales and marketing expense for fiscal 2018 compared to fiscal 2017 was primarily attributable to an increase of $51.0 million in personnel costs as a result of headcount increases, an increase of $7.5 million due to timing of marketing events, and one additional week of expenses of approximately $5.8 million in fiscal 2018.

General and Administrative

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
	(dollars in millions)						
	$ 229.2	$ 262.6	$ 196.8	$ (33.4)	(13)%	$ 65.8	33%
Percentage of total revenue	7%	8%	7%				

The decrease in general and administrative expenses for fiscal 2019 compared to fiscal 2018 was primarily due to a $26.0 million litigation settlement in the third quarter of fiscal 2018, a legal settlement of $18.3 million in our favor in the first quarter of fiscal 2019, and an additional week of expenses of approximately $4.1 million in fiscal 2018. The decreases were partially offset by a $7.1 million increase in personnel-related costs.

The increase in general and administrative expenses for fiscal 2018 compared with fiscal 2017 was primarily due to an increase of $21.5 million in personnel-related costs as a result of headcount increases, an increase of $22.1 million in professional service costs primarily due to additional legal, accounting, and tax services related to various projects, an increase of $18.2 million in net litigation settlement costs primarily due to a $26.0 million litigation settlement recorded in fiscal 2018 compared with $7.6 million net litigation charges recorded in fiscal 2017, an increase of $11.0 million in facilities expenses, and one additional week of expenses of approximately $4.1 million in fiscal 2018.

Changes in other general and administrative expense categories for the above-mentioned periods were not individually material.

Change in Fair Value of Deferred Compensation

The income or loss arising from the change in fair value of our non-qualified deferred compensation plan obligation is recorded in cost of sales and each functional operating expense, with the offsetting change in the fair value of the related assets recorded in other income (expense), net. These assets are classified as trading securities. There is no overall impact to our net income from the income or loss of our deferred compensation plan obligation and asset.

Amortization of Intangible Assets

Amortization of intangible assets includes the amortization of contract rights and the amortization of core/developed technology, trademarks, trade names, customer relationships, and in-process research and development related to acquisitions completed in prior years. Amortization expense is included in the consolidated statements of operations as follows:

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
	(dollars in millions)						
Included in cost of revenue	$ 59.6	$ 84.0	$ 76.1	$ (24.4)	(29)%	$ 7.9	10%
Included in operating expenses	41.3	41.6	31.6	(0.3)	(1)%	10.0	32%
Total	$ 100.9	$ 125.6	$ 107.7	$ (24.7)	(20)%	$ 17.9	17%
Percentage of total revenue	3%	4%	4%				

The decrease in amortization of intangible assets for fiscal 2019 compared to fiscal 2018 was primarily due to intangible assets that were fully amortized, partially offset by additions of acquired intangible assets in fiscal 2019.

The increase in amortization of intangible assets for fiscal 2018 compared to fiscal 2017 was primarily due to the additions of acquired intangible assets, partially offset by certain intangible assets being fully amortized.

Restructuring Charges

In the second quarter of fiscal 2019, our management approved, committed and initiated a restructuring plan (the Plan) as part of a business reorganization. Total charges under the Plan are expected to be $56 million to $65 million and consist primarily of severance, termination, and retirement benefits under the 2019 Voluntary Retirement Program (VRP). Restructuring charges under the Plan are anticipated to be completed by the second quarter of fiscal 2020.

The following is a summary of our restructuring activities:

Fiscal Year	Balance at Beginning of Period	Costs Incurred (Reduced)	Cash Payments	Balance at End of Period
		(in millions)		
2019	$ 8.1	$ 47.2	$ (32.7)	$ 22.6
2018	$ 17.5	$ 12.7	$ (22.1)	$ 8.1
2017	$ 5.7	$ 36.6	$ (24.8)	$ 17.5

See Note 2 of *Notes to Consolidated Financial Statements* for additional information.

Other Income (Expense), Net

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Interest income	$ 6.9	$ 5.3	$ 7.2	$ 1.6	30 %	$ (1.9)	(26)%
Interest expense	(11.7)	(15.6)	(7.3)	3.9	(25)%	(8.3)	114 %
Gain (loss) on assets related to executive deferred compensation plan	27.8	4.6	29.6	23.2	504 %	(25.0)	(84)%
Foreign currency exchange gain (loss)	3.6	3.6	3.4	—	— %	0.2	6 %
Other, net	(1.3)	5.4	2.6	(6.7)	(124)%	2.8	108 %
Total	$ 25.3	$ 3.3	$ 35.5	$ 22.0	667 %	$ (32.2)	(91)%

The net increase in other income (expense) in fiscal 2019 as compared to fiscal 2018 was primarily due to higher gains in the market value of our executive deferred compensation plan assets.

The net decrease in other income (expense) in fiscal 2018 as compared to fiscal 2017 was primarily due to lower gains in the market value of our executive deferred compensation plan assets and higher interest expense due to a higher debt balance.

Segment Operating Results

We do not allocate certain operating expenses managed at a consolidated level to our reportable segments. These unallocated expenses consist primarily of stock-based compensation expense, amortization of intangible assets, restructuring, litigation and acquisition-related costs. See Note 13 of the *Notes to Consolidated Financial Statements* for more information.

Semiconductor & System Design Segment

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
				(dollars in millions)			
Adjusted operating income	$ 806.6	$ 701.3	$ 667.2	$ 105.3	15%	$ 34.1	5 %
Adjusted operating margin	27%	25%	26%	2%	8%	(1)%	(4)%

The increase in adjusted operating income for fiscal 2019 compared to fiscal 2018 was primarily due to higher revenue recognized under ASC 606 of $97.5 million and an increase in revenue from arrangements booked in prior periods, partially offset by approximately $12.0 million due to an additional week of operating income in fiscal 2018.

The increase in adjusted operating income for fiscal 2018 compared to fiscal 2017 was primarily due to an additional week of operating income of approximately $12.0 million in fiscal 2018 and an increase in revenue from arrangements booked in prior periods.

Software Integrity Segment

	Year Ended October 31,			$ Change	% Change	$ Change	% Change
	2019	2018	2017	2018 to 2019		2017 to 2018	
	(dollars in millions)						
Adjusted operating income	$ 32.2	$ (10.6)	$ (19.9)	$ 42.8	(404)%	$ 9.3	(47)%
Adjusted operating margin	10%	(4)%	(11)%	14%	(350)%	7%	(64)%

The increase in adjusted operating income for fiscal 2019 compared to fiscal 2018 was primarily due to the impact of higher revenue recognized under ASC 606 of $5.0 million and an increase in revenue from arrangements booked in prior periods.

The increase in adjusted operating income for fiscal 2018 compared to fiscal 2017 was primarily due to an increase in revenue from arrangements booked in prior periods.

Income Taxes

The Tax Cuts and Jobs Act (Tax Act), enacted on December 22, 2017, lowered the statutory federal corporate income tax rate from 35% to 21% effective on January 1, 2018. Beginning in fiscal 2019, our annual statutory federal corporate tax rate is 21%.

Our effective tax rate for fiscal 2019 was 2.4%, which included a tax benefit of $28.1 million related to the realizability of U.S. foreign tax credits related to the transfer of intangibles associated with the tax restructuring in fiscal 2018, a U.S. federal research tax credit of $34.5 million, a foreign derived intangible income deduction (FDII) of $26.6 million, and excess tax benefits from stock-based compensation of $40.5 million.

Our effective tax rate for fiscal 2018 was (19.0%), which included a tax benefit of $172.0 million relating to the restructuring of our foreign intellectual property rights, a U.S. federal research tax credit of $35.1 million, a settlement with the Internal Revenue Service (IRS) of $21.8 million tax benefit for fiscal 2017, and excess tax benefits from stock-based compensation of $31.0 million. These benefits were partially offset by tax expense of $63.1 million for a one-time transition tax on foreign earnings, $51.1 million due to re-measurement of U.S. deferred tax assets as a result of the Tax Act, and tax expense related to the integration of acquired technologies of $27.9 million.

Our effective tax rate for fiscal 2017 was 64.4%, which included income tax expense of $166.2 million relating to a repatriation of foreign earnings of $825 million, $30.5 million due to an increase in valuation allowance on state deferred tax assets, a settlement with the Korean National Tax Service for the audit of fiscal years 2012 to 2016 of $7.9 million, and tax expense related to the integration of acquired technologies of $36.4 million. These expenses were partially offset by excess tax benefits from stock-based compensation of $38.1 million, a U.S. federal research tax credit of $25.5 million, and a settlement with the Taiwanese tax authorities for fiscal 2014 of $10.9 million.

The integration of acquired technologies represents the income tax effect resulting from the transfer of certain intangible assets among company-controlled entities. These intangible assets generally result from the acquisition of technology by a company-controlled entity as part of a business or asset acquisition.

The Tax Act required us to pay a one-time transition tax on previously untaxed earnings represented by foreign cash and certain other net current assets, and 8% on the remaining earnings. In fiscal 2018, we recorded a tax expense of $63.1 million. Based on subsequent judicial rulings in fiscal 2019 (including *Altera Corp. et al. v. Commissioner* and the Hungarian Administrative Court ruling, we recorded a tax benefit of $17.9 million related to the one-time transition tax. See Note 11 of *Notes to Consolidated Financial Statements* or further discussion.

We continue to obtain, analyze and interpret additional guidance issued related to the Tax Act. The applicability and impact of the following new tax provisions are dependent in part on forthcoming IRS guidance.

- A tax on global intangible low-tax income (GILTI), which is determined annually based on our aggregate foreign subsidiaries' income in excess of certain qualified business asset investment return. In fiscal 2019, the Company adopted an accounting policy to account for the tax effects of GILTI in the period that it is subject to such tax.
- A base erosion and anti-abuse tax (BEAT), which functions as a minimum tax that partially disallows deductions for certain related party transactions and certain tax credits.
- A special tax deduction for FDII, which, in general, allows a deduction of certain intangible income earned in the U.S. and derived from foreign sources.

The Tax Act also provides an exemption from federal income taxes for distributions from foreign subsidiaries made after December 31, 2017 that were not subject to the one-time transition tax. We have provided for foreign withholding taxes on undistributed earnings of certain of our foreign subsidiaries to the extent such earnings are no longer considered to be indefinitely reinvested in the operations of those subsidiaries.

In July 2017, the Hungarian Tax Authority (the HTA) issued a final assessment against our Hungarian subsidiary (Synopsys Hungary) for fiscal years 2011 through 2013. The HTA has applied withholding taxes on certain payments made to affiliates, resulting in an aggregate tax assessment of approximately $25.0 million and interest and penalties of $11.0 million. We paid the tax assessments, penalties and interest in the first quarter of 2018 as required by law and recorded these amounts as prepaid taxes on our balance sheet. On April 30, 2019, the Hungarian Administrative Court ruled against Synopsys Hungary. We filed an appeal with the Hungarian Supreme Court on July 5, 2019.

See Note 11 of *Notes to Consolidated Financial Statements* for further discussion of the provision for income taxes, the impacts related to the Tax Act, and the Hungarian audit.

Liquidity and Capital Resources

Our sources of cash and cash equivalents are funds generated from our business operations and funds that may be drawn down under our revolving credit and term loan facilities.

As of October 31, 2019, we held an aggregate of $191.6 million in cash and cash equivalents in the United States and an aggregate of $537.0 million in our foreign subsidiaries. As a result of the Tax Act, if we decide to repatriate the undistributed earnings of our foreign subsidiaries for use in the U.S. in the future, the earnings made after December 31, 2017 would not be subject to further U.S. tax. In addition, we have provided foreign deferred taxes on our undistributed earnings of $6.3 million in fiscal 2019, which is sufficient to address the incremental tax that would be due on future foreign earnings.

The following sections discuss changes in our consolidated balance sheets and statements of cash flow, and other commitments of our liquidity and capital resources during fiscal 2019.

Cash and Cash Equivalents

	Year Ended October 31,			
	2019	**2018**	**$ Change**	**% Change**
		(dollars in millions)		
Cash and cash equivalents	$ 728.6	$ 723.1	$ 5.5	1%

Cash and cash equivalents increased primarily due to cash from our operations and net proceeds from our credit facilities. The increase in cash and cash equivalents was partially offset by repayment of debt, stock repurchases, annual variable compensation payouts, and purchases of property and equipment.

Cash Flows

	Year Ended October 31,			$ Change	$ Change
	2019	2018	2017	2018 to 2019	2017 to 2018
	(dollars in millions)				
Cash provided by operating activities	$ 800.5	$ 424.4	$ 632.5	$ 376.1	$ (208.1)
Cash used in investing activities	$ (235.9)	$ (743.5)	$ (189.3)	$ 507.6	$ (554.2)
Cash provided by (used in) financing activities	$ (561.9)	$ 5.1	$ (373.1)	$ (567.0)	$ 378.2

Cash Provided by Operating Activities

We expect cash from our operating activities to fluctuate as a result of a number of factors, including the timing of our billings and collections, our operating results, and the timing and amount of tax and other liability payments. Cash provided by our operations is dependent primarily upon the payment terms of our license agreements. We generally receive cash from upfront arrangements much sooner than from time-based products revenue, in which the license fee is typically paid either quarterly or annually over the term of the license.

Fiscal 2019 compared to fiscal 2018. The increase in cash provided by operating activities was primarily driven by higher net income and higher cash collections, partially offset by higher disbursements for operations, including vendors.

Fiscal 2018 compared to fiscal 2017. The decrease in cash provided by operating activities was primarily driven by higher vendor disbursements, higher income taxes payment, higher accounts receivable due to timing of customer billings, and higher inventory. Disbursements in fiscal 2018 included certain one-time payments of $163.3 million for income taxes and $65.0 million for a litigation settlement.

Cash Used in Investing Activities

Fiscal 2019 compared to fiscal 2018. The decrease in cash used in investing activities was primarily driven by higher cash paid for acquisitions in fiscal 2018 of $616.0 million.

Fiscal 2018 compared to fiscal 2017. The increase in cash used in investing activities was primarily driven by higher cash paid for acquisitions of $393.4 million and lower proceeds from sales and maturities of short-term investments, net of purchases, of $128.1 million.

Cash Provided by (Used in) Financing Activities

Fiscal 2019 compared to fiscal 2018. Cash used in financing activities was higher primarily due to higher debt repayments of $228.8 million and lower proceeds from credit facilities drawdowns of $427.7 million.

Fiscal 2018 compared to fiscal 2017. Cash provided by financing activities was higher primarily due to higher proceeds of $300.6 million from drawdowns of our credit facilities and lower debt repayment of $85.3 million.

Accounts Receivable, net

	Year Ended October 31,			
	2019	2018	$ Change	% Change
	(dollars in millions)			
Accounts receivable, net	$ 553.9	$ 554.2	$ (0.3)	— %

Changes in our accounts receivable balance are primarily driven by the timing of customer billing and collection activities.

Working Capital

Working capital is comprised of current assets less current liabilities, as shown on our consolidated balance sheets:

	Year Ended October 31,			
	2019	2018	$ Change	% Change
	(dollars in millions)			
Current assets	$ 1,738.9	$ 1,543.8	$ 195.1	13 %
Current liabilities	1,752.5	2,102.4	(349.9)	(17)%
Working capital (deficit)	$ (13.6)	$ (558.6)	$ 545.0	(98)%

Increases in our working capital were primarily due to a decrease in short-term debt of $326.2 million, an increase in prepaid and other current assets of $222.5 million, and a decrease in accounts payable and accrued liabilities of $71.9 million, partially offset by an increase in cash and cash equivalents of $5.5 million.

Other Commitments— Credit and Term Loan Facilities

In July 2018, we entered into a 220.0 million RMB (approximately $33.0 million) credit agreement with a lender in China to support our facilities expansion. Borrowings bear interest at a floating rate based on the Chinese Central Bank rate plus 10% of such rate. As of October 31, 2019, we had $17.9 million outstanding under the agreement.

On November 28, 2016, we entered into an amended and restated credit agreement with several lenders (the Credit Agreement) providing for (i) a $650.0 million senior unsecured revolving credit facility (the Revolver) and (ii) a $150.0 million senior unsecured term loan facility (the Term Loan). The Credit Agreement amended and restated our previous credit agreement dated May 19, 2015, in order to increase the size of the revolving credit facility from $500.0 million to $650.0 million, provide a new $150.0 million senior unsecured term loan facility, and extend the termination date of the revolving credit facility from May 19, 2020 to November 28, 2021. Subject to obtaining additional commitments from lenders, the principal amount of the loans provided under the Credit Agreement may be increased by us by up to an additional $150.0 million. The Credit Agreement contains financial covenants requiring us to operate within a maximum leverage ratio and maintain a minimum interest coverage ratio, as well as other non-financial covenants. As of October 31, 2019, we were in compliance with all financial covenants.

As of October 31, 2019, we had $119.8 million outstanding balance, net of debt issuance costs, under the Term Loan, of which $102.2 million was classified as long-term liabilities. Outstanding principal payments under the Term Loan are due as follows:

Fiscal year	(in thousands)
2020	$ 17,813
2021	27,187
2022	75,000
Total	$ 120,000

As of October 31, 2018, we had $133.8 million outstanding balance, net of debt issuance costs, under the Term loan, of which $120.0 million was classified as long-term liabilities. The total outstanding balance under the Revolver as of October 31, 2018 was $330.0 million, which was included in short-term liabilities.

There was no outstanding balance under the Revolver as of October 31, 2019. We expect our borrowings under the Revolver will fluctuate from quarter to quarter. Borrowings bear interest at a floating rate based on a margin over our choice of market observable base rates as defined in the Credit Agreement. As of October 31, 2019, borrowings under the Term Loan bore interest at LIBOR +1.125% and the applicable interest rate for the Revolver was LIBOR +1.000%. In addition, commitment fees are payable on the Revolver at rates between 0.125% and 0.200% per year based on our leverage ratio on the daily amount of the revolving commitment.

Subsequent to fiscal year 2019, we drew down $160.0 million under the Revolver. The total outstanding balance of the Revolver as of December 20, 2019 is $160.0 million, net of repayments.

Other

As of October 31, 2019, our cash equivalents consisted of taxable money market mutual funds. We follow an established investment policy and set of guidelines to monitor, manage and limit our exposure to interest rate and credit risk.

We proactively manage our cash equivalents balances and closely monitor our capital and stock repurchase expenditures to ensure ample liquidity. Additionally, we believe the overall credit quality of our portfolio is strong, with our global excess cash, and our cash equivalents, invested in banks and securities with a weighted-average credit rating exceeding AA. The majority of our investments are classified as Level 1 or Level 2 investments, as measured under fair value guidance. See Notes 5 and 6 of *Notes to Consolidated Financial Statements*.

We believe that our current cash and cash equivalents, cash generated from operations, and available credit under our Revolver will satisfy our routine business requirements for at least the next 12 months and the foreseeable future.

Contractual Obligations

Contractual obligations as of October 31, 2019 are as follows:

	Total	Fiscal 2020	Fiscal 2021/ Fiscal 2022	Fiscal 2023/ Fiscal 2024	Thereafter	Other
			(in thousands)			
Lease Obligations:						
Operating Leases[1]	$ 622,599	$ 79,286	$ 149,180	$ 102,639	$ 291,494	$ —
Purchase Obligations[2]	383,339	290,502	87,680	5,157	—	—
Term Loan[3]	120,000	17,813	102,187	—	—	—
Other Long-Term Obligations[4]	1,725	862	863	—	—	—
Long term accrued income taxes[5]	29,911	—	—	—	—	29,911
Total	$ 1,157,574	$ 388,463	$ 339,910	$ 107,796	$ 291,494	$ 29,911

(1) See Note 7 of *Notes to Consolidated Financial Statements*.

(2) Purchase obligations represent an estimate of all open purchase orders and contractual obligations in the ordinary course of business for which we have not received the goods or services as of October 31, 2019. Although open purchase orders are considered enforceable and legally binding, the terms generally allow us the option to cancel, reschedule, and adjust our requirements based on our business needs prior to the delivery of goods or performance of services.

(3) These commitments relate to the principal of the Term Loan and a credit facility as discussed in *Other Commitments* above.

(4) These other obligations include fees associated with our credit facility.

(5) Long-term accrued income taxes represent uncertain tax benefits as of October 31, 2019. Currently, a reasonably reliable estimate of timing of payments related to uncertain tax benefits in individual years beyond fiscal 2019 cannot be made due to uncertainties in timing of the commencement and settlement of potential tax audits.

The expected timing of payments of the obligations discussed above is estimated based on current information. Timing of payment and actual amounts paid may be different depending on the time of receipt of goods or services or changes to agreed-upon amounts for some obligations.

Off-Balance Sheet Arrangements

As of October 31, 2019, we did not have any off-balance sheet arrangements, as defined in Item 303(a)(4)(ii) of SEC Regulation S-K.

Item 7A. *Quantitative and Qualitative Disclosures About Market Risk*

Interest Rate Risk. Our exposure to market risk for changes in interest rates relates to our cash, cash equivalents, and outstanding debt. As of October 31, 2019, all of our cash, cash equivalents, and debt were at short-term variable and fixed interest rates. While par value generally approximates fair value on variable instruments, rising interest rates over time would increase both our interest income and our interest expense. The primary objective of our investment activities is to preserve the principal while at the same time maximizing yields without significantly increasing the risk. To achieve this objective, we maintain our portfolio of investments in a mix of tax-exempt and taxable instruments that meet high credit quality standards, as specified in our investment policy. None of these investments are held for trading purposes. Our policy also limits the amount of credit exposure to any one issue, issuer and type of instrument.

Our cash equivalents and debt by fiscal year of expected maturity and average interest rates as of October 31, 2019 are as follows:

	Maturing in Year Ending October 31,						
	2020	2021	2022	2023	2024	Total	Fair Value
				(in thousands)			
Cash & Cash equivalent (variable rate)	$ 598,027					$ 598,027	$ 598,027
Approx. average interest rate	1.03%						
Short-term debt (variable rate):							
Revolver	$ —					$ —	$ —
Average interest rate	$ —						
Term Loan	$ 17,813	$ 27,187	$ 75,000	$ —		$ 120,000	$ 120,000
Average interest rate	LIBOR + 1.125%						
Credit Facility in China	$ 17,905					$ 17,905	$ 17,905
Average interest rate	Chinese Central Bank rate + 10% of such rate						

Foreign Currency Risk. We operate internationally and are exposed to potentially adverse movements in currency exchange rates. The functional currency of the majority of our active foreign subsidiaries is the foreign subsidiary's local currency. We enter into hedges in the form of foreign currency forward contracts to reduce our exposure to foreign currency rate changes on non-functional currency denominated forecasted transactions and balance sheet positions including: (1) certain assets and liabilities, (2) shipments forecasted to occur within approximately one month, (3) future billings and revenue on previously shipped orders, and (4) certain future intercompany invoices denominated in foreign currencies. The foreign currency contracts are carried at fair value and denominated in various currencies as listed in the tables below. The duration of forward contracts usually ranges from one month to 22 months. See Note 2 and Note 5 of *Notes to Consolidated Financial Statements* for a description of our accounting for foreign currency contracts.

The success of our hedging activities depends upon the accuracy of our estimates of various balances and transactions denominated in non-functional currencies. To the extent our estimates are correct, gains and losses on our foreign currency contracts will be offset by corresponding losses and gains on the underlying transactions. For example, if the Euro were to depreciate by 10% compared to the U.S. dollar prior to the settlement of the Euro forward contracts listed in the table below providing information as of October 31, 2019, the fair value of the contracts would decrease by approximately $10.4 million, and we would be required to pay approximately $10.4 million to the counterparty upon contract maturity. At the same time, the U.S. dollar value of our Euro-based expenses would decline, resulting in a gain and positive cash flow of approximately $10.4 million that would offset the loss and negative cash flow on the maturing forward contracts.

Net unrealized loss of approximately $4.5 million and $23.9 million, net of tax, are included in accumulated other comprehensive income (loss) in our consolidated balance sheets as of October 31, 2019 and 2018, respectively.

If estimates of our balances and transactions prove inaccurate, we will not be completely hedged, and we will record a gain or loss, depending upon the nature and extent of such inaccuracy.

We do not use foreign currency forward contracts for speculative or trading purposes. We enter into foreign exchange forward contracts with financial institutions and have not experienced nonperformance by counterparties. Further, we anticipate performance by all counterparties to such agreements.

Information about the gross notional values of our foreign currency contracts as of October 31, 2019 was as follows:

	Gross Notional Amount in U.S. Dollars	Average Contract Rate
	(in thousands)	
Forward Contract Values:		
Japanese yen	$ 266,383	106.829
Indian rupee	118,635	74.243
Euro	104,142	1.148
Hungarian forint	88,164	294.994
Canadian dollar	49,633	1.318
Taiwanese dollar	48,831	30.291
Chinese renminbi	39,606	7.040
Korean won	37,039	1,176.930
British pound sterling	27,395	1.284
Armenian dram	10,784	471.530
Israel shekel	9,840	3.524
Singapore dollar	8,950	1.370
Swiss franc	8,039	0.971
	$ 817,441	

Equity Risk. We have approximately $11.0 million and $10.9 million of non-marketable equity securities in privately held companies as of October 31, 2019 and 2018, respectively. These investments are accounted for under the cost or equity methods. The cost basis of securities sold is based on the specific identification method. The securities of privately held companies are reported at carrying value. Investments are written down to the fair value if there are any events or changes in circumstances that indicate any other than temporary decline in the value. We did not recognize any impairment during fiscal 2019 and 2018. None of our investments are held for speculation purposes.

Item 8. *Financial Statements and Supplementary Data*

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors

Synopsys, Inc.:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of Synopsys, Inc. and subsidiaries (the Company) as of November 2, 2019 and November 3, 2018, the related consolidated statements of operations, comprehensive income, stockholders' equity, and cash flows for each of the years in the three-year period ended November 2, 2019, and the related notes (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of November 2, 2019, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of November 2, 2019 and November 3, 2018, and the results of its operations and its cash flows for each of the years in the three-year period ended November 2, 2019, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of November 2, 2019 based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

Change in Accounting Principle

As discussed in Note 2 to the consolidated financial statements, the Company has changed its method of accounting for revenue from contracts with customers and sales commissions as of November 4, 2018, due to the adoption of Financial Accounting Standards Board's Accounting Standards Codification (ASC) Topic 606, *Revenue from Contracts with Customers,* and Subtopic 340-40, *Other Assets and Deferred Costs - Contracts with Customers*.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control Over Financial Reporting appearing under item 9A(b). Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the consolidated financial statements that were communicated or required to be communicated to the audit committee and that: (1) relate to accounts or disclosures that are material to the consolidated financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Assessment of performance obligations

As discussed in Notes 2 to the consolidated financial statements, the Company has determined that its software licenses in Technology Subscription License offerings (TSLs) are not distinct from its obligation to provide unspecified software updates. In these situations revenue is recognized ratably over the subscription period for which the updates are provided.

We identified the assessment of performance obligations in TSL arrangements as a critical audit matter. Especially challenging auditor judgment was required to assess whether receiving updates to the licensed software is integral to maintaining the software's utility to the customer throughout the contracted TSL period, and therefore integral to fulfilling the Company's promise to the customer in its TSLs.

The primary procedures we performed to address this critical audit matter included the following. We tested certain internal controls over the Company's revenue recognition process, including controls over the determination of performance obligations in their revenue arrangements. We read the standard terms and conditions provided to customers purchasing TSLs to identify the commitments being made in the contracts. We obtained and examined the Company's marketing materials and publicly available information about the offerings to evaluate how the offerings are marketed and sold to customers, including how the right to unspecified software updates was portrayed. We interviewed individuals in the Company's product and engineering department to both understand the nature of the updates typically provided to TSL customers and whether such updates are integral to maintaining the utility of the software over a typical TSL period. We also observed updates that have historically been provided as part of the TSLs as to their nature and frequency.

Assessment of recognition of uncertain tax positions

As discussed in Notes 2 and 11 to the consolidated financial statements, as of November 2, 2019 the Company has recognized uncertain tax positions. The Company recognizes tax benefits from uncertain tax positions only if there is more than a 50% likelihood that the tax position will be sustained upon examination by the taxing authorities based on the technical merits of the position. As of November 2, 2019, the Company has recorded a liability for gross unrecognized tax benefits, excluding associated interest and penalties, of $116.2 million.

We identified the assessment of recognition of uncertain tax positions as a critical audit matter. Complex auditor judgment, including the involvement of tax professionals with specialized skills and knowledge, was required to evaluate the Company's interpretation and application of tax law globally across its multiple subsidiaries. In addition, a higher degree of auditor judgment was required in evaluating the Company's estimate of the ultimate resolution of its tax positions.

The primary procedures we performed to address this critical audit matter included the following. We tested certain internal controls over the Company's unrecognized tax benefit process, including controls related to the interpretation of tax law and its application in the liability estimation process. Since tax law is complex and often subject to interpretation, we involved tax professionals with specialized skills and knowledge, who assisted in:

- Obtaining an understanding of the Company's overall tax structure and assessing the Company's compliance with tax laws globally,
- Evaluating changes in the Company's overall tax structure that occurred during the year as well as changes in tax law, and assessing the interpretation of those changes under the relevant jurisdiction's tax law,
- Inspecting correspondence, assessments, and settlements from taxing authorities to assess the Company's determination of its tax positions having more than a 50% likelihood to be sustained upon examination, and
- Performing an independent assessment of the Company's uncertain tax positions and comparing the results to the Company's evaluation.

/s/ KPMG LLP

We have served as the Company's auditor since 1992.

Santa Clara, California
December 20, 2019

SYNOPSYS, INC.
CONSOLIDATED BALANCE SHEETS
(In thousands, except par value amounts)

	October 31, 2019	October 31, 2018
ASSETS		
Current assets:		
Cash and cash equivalents	$ 728,597	$ 723,115
Accounts receivable, net	553,895	554,217
Inventories	141,518	122,407
Income taxes receivable and prepaid taxes	24,855	76,525
Prepaid and other current assets	290,052	67,533
Total current assets	1,738,917	1,543,797
Property and equipment, net	429,532	309,310
Goodwill	3,171,179	3,143,249
Intangible assets, net	279,374	360,404
Long-term prepaid taxes	15,503	138,312
Deferred income taxes	390,129	404,166
Other long-term assets	380,526	246,736
Total assets	$ 6,405,160	$ 6,145,974
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable and accrued liabilities	$ 506,459	$ 578,326
Accrued income taxes	15,904	27,458
Deferred revenue	1,212,476	1,152,862
Short-term debt	17,614	343,769
Total current liabilities	1,752,453	2,102,415
Long-term accrued income taxes	29,911	50,590
Long-term deferred revenue	90,102	116,859
Long-term debt	120,093	125,535
Other long-term liabilities	323,725	265,560
Total liabilities	2,316,284	2,660,959
Stockholders' equity:		
Preferred stock, $0.01 par value: 2,000 shares authorized; none outstanding	—	—
Common stock, $0.01 par value: 400,000 shares authorized; 150,331 and 149,265 shares outstanding, respectively	1,503	1,493
Capital in excess of par value	1,635,455	1,644,830
Retained earnings	3,164,144	2,543,688
Treasury stock, at cost: 6,930 and 7,996 shares, respectively	(625,642)	(597,682)
Accumulated other comprehensive income (loss)	(92,447)	(113,177)
Total Synopsys stockholders' equity	4,083,013	3,479,152
Non-controlling interest	5,863	5,863
Total stockholders' equity	4,088,876	3,485,015
Total liabilities and stockholders' equity	$ 6,405,160	$ 6,145,974

See accompanying notes to consolidated financial statements.

SYNOPSYS, INC.
CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except per share amounts)

	Year Ended October 31,		
	2019	2018	2017
Revenue:			
Time-based products	$ 2,197,965	$ 2,303,317	$ 2,021,812
Upfront products	619,791	357,698	338,204
Maintenance and service	542,938	460,043	364,864
Total revenue	3,360,694	3,121,058	2,724,880
Cost of revenue:			
Products	459,127	448,430	413,203
Maintenance and service	234,196	203,434	164,872
Amortization of intangible assets	59,623	84,034	76,109
Total cost of revenue	752,946	735,898	654,184
Gross margin	2,607,748	2,385,160	2,070,696
Operating expenses:			
Research and development	1,136,932	1,084,822	908,841
Sales and marketing	632,890	622,978	549,248
General and administrative	229,218	262,560	196,844
Amortization of intangible assets	41,291	41,630	31,614
Restructuring charges	47,186	12,945	36,586
Total operating expenses	2,087,517	2,024,935	1,723,133
Operating income	520,231	360,225	347,563
Other income (expense), net	25,275	3,318	35,535
Income before income taxes	545,506	363,543	383,098
Provision (benefit) for income taxes	13,139	(68,975)	246,535
Net income	$ 532,367	$ 432,518	$ 136,563
Net income per share:			
Basic	$ 3.55	$ 2.90	$ 0.91
Diluted	$ 3.45	$ 2.82	$ 0.88
Shares used in computing per share amounts:			
Basic	149,872	149,036	150,457
Diluted	154,190	153,393	154,874

See accompanying notes to consolidated financial statements.

SYNOPSYS, INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME
(In thousands)

	Year Ended October 31,		
	2019	2018	2017
Net income	$ 532,367	$ 432,518	$ 136,563
Other comprehensive income (loss):			
Change in foreign currency translation adjustment	1,360	(18,882)	14,293
Change in unrealized gains (losses) on investments, net of tax of $0, for fiscal year 2017	—	—	(19)
Cash flow hedges:			
Deferred gains (losses), net of tax of $(2,009), $4,675, and $(4,380) for fiscal years 2019, 2018 and 2017, respectively	4,733	(17,428)	20,760
Reclassification adjustment on deferred (gains) losses included in net income, net of tax of $(3,672), $2,207, and $(168) for fiscal years 2019, 2018 and 2017, respectively	14,637	(10,888)	3,564
Other comprehensive income (loss), net of tax effects	20,730	(47,198)	38,598
Comprehensive income	$ 553,097	$ 385,320	$ 175,161

See accompanying notes to consolidated financial statements.

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SYNOPSYS, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(In thousands)

	Common Stock		Capital in Excess of Par Value	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive Income (Loss)	Total Synopsys Stockholders' Equity	Non-controlling Interest	Stockholders' Equity
	Shares	Amount							
Balance at October 31, 2016	151,454	$ 1,515	$1,644,675	$1,947,585	$(294,052)	$ (104,577)	$ 3,195,146	$ —	$ 3,195,146
Net income				136,563			136,563		136,563
Retained earnings adjustment due to adoption of an accounting standard related to stock-based compensation			382	106,107			106,489		106,489
Other comprehensive income (loss), net of tax effects						38,598	38,598		38,598
Purchases of treasury stock	(5,413)	(54)	54		(380,000)		(380,000)		(380,000)
Equity forward contract			(20,000)				(20,000)		(20,000)
Common stock issued, net of shares withheld for employee taxes	4,404	44	(110,976)	(46,382)	247,844		90,530		90,530
Stock-based compensation			108,294				108,294		108,294
Non-controlling interest in an equity investment							—	4,104	4,104
Balance at October 31, 2017	150,445	$ 1,505	$1,622,429	$2,143,873	$(426,208)	$ (65,979)	$ 3,275,620	$ 4,104	$ 3,279,724
Net income				432,518			432,518		432,518
Retained earnings adjustment due to adoption of an accounting standard in reclassification of certain tax effects from accumulated other comprehensive income (loss)				(293)			(293)		(293)
Other comprehensive income (loss), net of tax effects						(47,198)	(47,198)		(47,198)
Purchases of treasury stock	(4,688)	(47)	47		(420,000)		(420,000)		(420,000)
Equity forward contract			20,000				20,000		20,000
Common stock issued, net of shares withheld for employee taxes	3,508	35	(136,522)	(32,410)	248,526		79,629		79,629
Stock-based compensation			138,876				138,876		138,876
Non-controlling interest in an equity investment							—	1,759	1,759
Balance at October 31, 2018	149,265	$ 1,493	$1,644,830	$2,543,688	$(597,682)	$ (113,177)	$ 3,479,152	$ 5,863	$ 3,485,015
Net income				532,367			532,367		532,367
Retained earnings adjustment due to adoption of accounting standards related to revenue(1)				257,594			257,594		257,594
Retained earnings adjustment due to adoption of an accounting standard related to income taxes(2)				(130,544)			(130,544)		(130,544)
Other comprehensive income (loss), net of tax effects						20,730	20,730		20,730
Purchases of treasury stock	(2,732)	(27)	27		(329,185)		(329,185)		(329,185)
Common stock issued, net of shares withheld for employee taxes	3,798	37	(163,198)	(38,961)	301,225		99,103		99,103
Stock-based compensation			153,796				153,796		153,796
Balance at October 31, 2019	150,331	$ 1,503	$1,635,455	$3,164,144	$(625,642)	$ (92,447)	$ 4,083,013	$ 5,863	$ 4,088,876

(1) See *Note 2. Summary of Significant Accounting Policies* for additional information on the retained earnings adjustment due to adoption of Accounting Standards Codification (ASC) 606 and ASC 340, "Other Assets and Deferred Costs".
(2) See *Note 11. Income Taxes* for additional information on the retained earnings adjustment due to adoption of Accounting Standard Update (ASU) 2016-16.

See accompanying notes to consolidated financial statements.

SYNOPSYS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(In thousands)

	Year Ended October 31,		
	2019	2018	2017
Cash flow from operating activities:			
Net income	$ 532,367	$ 432,518	$ 136,563
Adjustments to reconcile net income to net cash provided by operating activities:			
Amortization and depreciation	201,676	209,207	189,442
Amortization of capitalized costs to obtain revenue contracts	62,750	—	—
Stock-based compensation	155,001	140,032	108,294
Allowance for doubtful accounts	11,669	3,368	2,149
(Gain) loss on sale of property and investments	(4,052)	(93)	8
Write-down of long-term investments	—	—	1,300
Deferred income taxes	(82,620)	(210,310)	123,052
Net changes in operating assets and liabilities, net of acquired assets and liabilities:			
Accounts receivable	(8,575)	(95,785)	2,296
Inventories	(19,243)	(66,509)	(20,137)
Prepaid and other current assets	(49,779)	(12,652)	(10,948)
Other long-term assets	(124,895)	(25,908)	(40,189)
Accounts payable and accrued liabilities	(19,280)	49,043	137,631
Income taxes	19,777	(103,841)	19,665
Deferred revenue	125,717	105,329	(16,644)
Net cash provided by operating activities	800,513	424,399	632,482
Cash flows from investing activities:			
Proceeds from sales and maturities of short-term investments	—	12,449	295,633
Purchases of short-term investments	—	—	(155,098)
Proceeds from sales of long-term investments	6,361	494	839
Purchases of long-term investments	(3,245)	(3,561)	—
Proceeds from sale of property and equipment	—	1,662	—
Purchases of property and equipment	(198,129)	(98,976)	(70,328)
Cash paid for acquisitions and intangible assets, net of cash acquired	(36,605)	(652,643)	(259,202)
Capitalization of software development costs	(4,259)	(2,950)	(3,226)
Other	—	—	2,100
Net cash used in investing activities	(235,877)	(743,525)	(189,282)
Cash flows from financing activities:			
Proceeds from credit facilities	192,897	620,635	320,000
Repayment of debt	(524,063)	(295,313)	(380,625)
Issuances of common stock	156,364	123,829	126,337
Payments for taxes related to net share settlement of equity awards	(57,143)	(45,772)	(36,730)
Purchase of equity forward contract	—	—	(20,000)
Purchases of treasury stock	(329,185)	(400,000)	(380,000)
Other	(762)	1,759	(2,102)
Net cash (used in) provided by financing activities	(561,892)	5,138	(373,120)
Effect of exchange rate changes on cash, cash equivalents and restricted cash	2,782	(11,086)	(427)
Net change in cash, cash equivalents and restricted cash	5,526	(325,074)	69,653
Cash, cash equivalents and restricted cash, beginning of year	725,001	1,050,075	980,422
Cash, cash equivalents and restricted cash, end of year	$ 730,527	$ 725,001	$ 1,050,075
Supplemental disclosure of cash flow information:			
Cash paid for income taxes during the year:	$ 75,744	$ 252,522	$ 103,478
Interest payments during the year:	$ 12,363	$ 15,307	$ 7,095

See accompanying notes to consolidated financial statements.

Note 1. Description of Business

Synopsys, Inc. (Synopsys or the Company) provides products and services used across the entire silicon to software spectrum, from engineers creating advanced semiconductors to software developers seeking to ensure the security and quality of their code. The Company is a global leader in supplying the electronic design automation (EDA) software that engineers use to design and test integrated circuits (ICs), also known as chips. The Company also offers semiconductor intellectual property (IP) products, which are pre-designed circuits that engineers use as components of larger chip designs rather than designing those circuits themselves. The Company provides software and hardware used to validate the electronic systems that incorporate chips and the software that runs on them. To complement these offerings, the Company provides technical services and support to help its customers develop advanced chips and electronic systems. These products and services are part of the Company’s Semiconductor & System Design segment.

The Company is also a leading provider of software tools and services that improve the security and quality of software code in a wide variety of industries, including electronics, financial services, media, automotive, medicine, energy and industrials. These tools and services are part of the Company’s Software Integrity segment.

Note 2. Summary of Significant Accounting Policies

Fiscal Year End. The Company’s fiscal year generally ends on the Saturday nearest to October 31 and consists of 52 weeks, with the exception that every five or six years, the Company has a 53-week year. When a 53-week year occurs, the Company includes the additional week in the first quarter to realign fiscal quarters with calendar quarters. Fiscal 2019 and fiscal 2017 were 52-week years ending on November 2, 2019 and October 28, 2017, respectively. Fiscal 2018 was a 53-week year and ended on November 3, 2018. For presentation purposes, the consolidated financial statements and accompanying notes refer to the closest calendar month end. Fiscal 2020 will be a 52-week year.

Principles of Consolidation. The consolidated financial statements include the accounts of the Company and all of its subsidiaries. All significant intercompany accounts and transactions have been eliminated.

Use of Estimates. To prepare financial statements in conformity with U.S. generally accepted accounting principles (U.S. GAAP), management must make estimates and assumptions that affect the amounts reported in the consolidated financial statements and accompanying notes. Actual results could differ from these estimates and may result in material effects on the Company’s operating results and financial position.

Segment Reporting. Effective in fiscal 2019, the Company realigned its business to evaluate the results of its Software Integrity business separately from the Company's traditional EDA and semiconductor IP business. The Chief Operating Decision Makers (CODMs) now regularly review disaggregated information for the following two reportable segments: (1) Semiconductor & System Design, which includes EDA tools, IP products, system integration solutions and other revenue categories, and (2) Software Integrity, which includes a comprehensive solution for building integrity—security, quality and compliance testing—into the customers’ software development lifecycle and supply chain. Synopsys' CODMs are the Company's two co-Chief Executive Officers. The Company's historical results have been recast to retrospectively reflect the change from one to two reportable segments.

Foreign Currency Translation. The functional currency of the majority of the Company’s active foreign subsidiaries is the foreign subsidiary’s local currency. Assets and liabilities that are not denominated in the functional currency are remeasured into the functional currency with any related gain or loss recorded in earnings. The Company translates assets and liabilities of its non-U.S. dollar functional currency foreign operations into the U.S. dollar reporting currency at exchange rates in effect at the balance sheet date. The Company translates income and expense items of such foreign operations into the U.S. dollar reporting currency at average exchange rates for the period. Accumulated translation adjustments are reported in stockholders’ equity, as a component of accumulated other comprehensive income (loss).

Foreign Currency Contracts. The Company operates internationally and is exposed to potentially adverse movements in currency exchange rates. The Company enters into hedges in the form of foreign currency forward contracts to reduce its exposure to foreign currency rate changes on non-functional currency denominated forecasted transactions and balance sheet positions. The assets or liabilities associated with the forward contracts are recorded at fair value in other current assets or accrued liabilities in the consolidated balance sheets.

The accounting for gains and losses resulting from changes in fair value depends on the use of the foreign currency forward contract and whether it is designated and qualifies for hedge accounting. See *Note 5. Financial Assets and Liabilities.*

Fair Values of Financial Instruments. The Company's cash equivalents and foreign currency contracts are carried at fair value. The fair value of the Company's accounts receivable and accounts payable approximates the carrying amount due to their short duration. Non-marketable equity securities are carried at cost, net of impairments. The Company performs periodic impairment analysis on these non-marketable equity securities. The carrying amount of the short-term debt approximates the estimated fair value. See *Note 6. Fair Value Measures*.

Cash and Cash Equivalents. The Company classifies investments with original maturities of three months or less when acquired as cash equivalents.

Concentration of Credit Risk. Financial instruments that potentially subject the Company to significant concentrations of credit risk consist principally of cash equivalents, marketable securities, foreign currency contracts, and accounts receivable from trade customers. The Company maintains cash equivalents primarily in highly rated taxable and tax-exempt money market funds located in the U.S. and in various overseas locations.

The Company sells its products worldwide primarily to customers in the global electronics market. The Company performs on-going credit evaluations of its customers' financial condition and does not require collateral. The Company establishes reserves for potential credit losses and such losses have been within management's expectations and have not been material in any year presented.

Accounts Receivable, Net. The balances consist of accounts receivable billed and unbilled. Unbilled accounts receivable represent amounts recorded as revenue which will be invoiced within one year of the balance sheet date. The following table represents the components of accounts receivable, net:

	October 31,	
	2019	2018
	(in thousands)	
Accounts receivable	$ 524,766	$ 495,763
Unbilled accounts receivable	38,175	64,067
Total accounts receivable	562,941	559,830
Less allowance for doubtful accounts	(9,046)	(5,613)
Total accounts receivable, net	$ 553,895	$ 554,217

Allowance for Doubtful Accounts. Trade accounts receivable are recorded at the invoiced amount and do not bear interest. The Company maintains allowances for doubtful accounts to reduce the Company's receivables to their estimated net realizable value. The Company provides a general reserve on all accounts receivable based on a review of customer accounts. The following table presents the changes in the allowance for doubtful accounts:

Fiscal Year	Balance at Beginning of Period	Provisions	Write-offs(1)	Balance at End of Period
	(in thousands)			
2019	$ 5,613	$ 11,669	$ (8,236)	$ 9,046
2018	$ 5,165	$ 3,368	$ (2,920)	$ 5,613
2017	$ 3,201	$ 2,149	$ (185)	$ 5,165

(1) Balances written off, net of recoveries.

Inventories. Inventories primarily include components and parts used in emulation and prototyping hardware systems. Inventory cost is computed using standard costs, which approximate actual costs, on a first-in, first-out basis and recorded at lower of cost or net realizable value. A charge is recorded to cost of product when inventory is determined to be in excess of anticipated demand or considered obsolete.

Income Taxes. The Company accounts for income taxes using the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

The Company accounts for uncertainty in income taxes using a two-step approach to recognizing and measuring uncertain tax positions. The first step is to evaluate the tax position for recognition by determining whether it is more likely than not that the position will be sustained on audit, including resolution of related appeals or litigation processes, if any. The second step is to measure the tax benefit as the largest amount which is more than 50% likely of being realized upon ultimate settlement. An uncertain tax position is considered effectively settled on completion of an examination by a taxing authority if certain other conditions are satisfied.

Property and Equipment. Property and equipment is recorded at cost less accumulated depreciation. Assets, excluding land, are depreciated using the straight-line method over their estimated useful lives. Leasehold improvements are amortized using the straight-line method over the remaining term of the lease or the economic useful life of the asset, whichever is shorter. Depreciation expenses were $100.4 million, $72.8 million and $82.8 million in fiscal 2019, 2018 and 2017, respectively. Repair and maintenance costs are expensed as incurred and such costs were $52.5 million, $45.7 million and $40.6 million in fiscal 2019, 2018 and 2017, respectively.

A summary of property and equipment, at cost less accumulated depreciation and amortization, as of October 31, 2019 and 2018 is as follows:

	October 31,	
	2019	2018
	(in thousands)	
Computer and other equipment	$ 678,901	$ 604,117
Buildings	68,708	68,522
Furniture and fixtures	72,437	61,070
Land	18,849	18,849
Leasehold improvements	273,985	183,430
	1,112,880	935,988
Less accumulated depreciation and amortization(1)	(683,348)	(626,678)
Total	$ 429,532	$ 309,310

(1) Accumulated depreciation and amortization includes write-offs due to retirement of fully amortized fixed assets.

The useful lives of depreciable assets are as follows:

	Useful Life in Years
Computer and other equipment	3-8
Buildings	30
Furniture and fixtures	5
Leasehold improvements	Shorter of the lease term or the estimated useful life

Goodwill. Effective in the first quarter of fiscal 2019, with the change in the Company's reportable segment structure, the Company has determined there are now two reporting units. Goodwill is allocated to the two reporting units using a relative fair value method.

Goodwill represents the excess of the aggregate purchase price over the fair value of the net tangible and identifiable intangible assets acquired by the Company. The carrying amount of goodwill at each reporting unit is tested for impairment annually as of October 31, or more frequently if facts and circumstances warrant a review. As a result of changes to the Company's segment reporting, the Company conducted a quantitative impairment test for each of its reporting units in the first quarter of fiscal 2019 and concluded that there was no impairment.

The Company performs either a qualitative or quantitative analysis when testing a reporting unit's goodwill for impairment. A qualitative goodwill impairment test is performed when the fair value of a reporting unit historically has significantly exceeded the carrying value of its net assets and based on current operations is expected to continue to do so. Otherwise, the Company is required to conduct a quantitative impairment test for each reporting unit and estimate the fair value of each reporting unit using a combination of an income approach based on discounted cash flow analysis and a market approach based on market multiples. The discount rate used in the income approach is based on the Company's weighted-average cost of capital and may be adjusted for the relevant risks pertaining to projecting future cash flows. If the fair value of a reporting unit is less than its carrying value, a goodwill impairment charge is recorded for the difference. As of October 31, 2019, the Company performed a qualitative impairment test on each of the reporting units and concluded no goodwill impairments.

Intangible Assets. Intangible assets consist of acquired technology, certain contract rights, customer relationships, trademarks and trade names, capitalized software, and in-process research and development. These intangible assets are acquired through business combinations, direct purchases, or internally developed capitalized software. Intangible assets are amortized on a straight-line basis over their estimated useful lives which range from one to ten years, except for in-process research and development (IPR&D) projects not yet completed. IPR&D assets are amortized over their estimated useful lives upon completion or are written off upon abandonment.

The Company continually monitors events and changes in circumstances that could indicate carrying amounts of long-lived assets, including property and equipment and intangible assets, may not be recoverable. When such events or changes in circumstances occur, the Company assesses the recoverability of long-lived assets by determining whether the carrying value of such asset group will be recovered through the undiscounted future cash flow. If the undiscounted future cash flow is less than the carrying amount of the asset group, the Company recognizes an impairment loss based on the excess of the carrying amount over the fair value of the asset group. The Company had no material impairment charges for long-lived assets in fiscal 2019 and 2018, and none in fiscal 2017.

Restructuring Charges. In the second quarter of fiscal 2019, the Company initiated restructuring plans for involuntary and voluntary employee termination and facility closure actions as part of a business reorganization to better position the Company for future growth by reallocating resources to priority areas, and to a lesser extent, eliminating operational redundancy. The total charges under the 2019 restructuring plans are expected to be $56 million to $65 million and consist primarily of severance, termination, and retirement benefits under the 2019 Voluntary Retirement Program (VRP). The actual total charges depend, in part, on the number of eligible employees accepting offers of the VRP. The 2019 restructuring plans are anticipated to be completed by the second quarter of fiscal 2020.

During fiscal 2019, the Company incurred restructuring charges of approximately $47.2 million for involuntary employee termination actions and the VRP. These charges consist primarily of severance, termination, and retirement benefits, of which $24.6 million was paid in fiscal 2019. As of October 31, 2019, $22.6 million remained outstanding and was recorded in accounts payable and accrued liabilities as payroll and related benefits in the consolidated balance sheets. The remaining balance will be paid in fiscal 2020.

During fiscal 2018, the Company recorded $12.9 million of restructuring charges for severance and benefits due to involuntary employee termination actions. The restructuring actions were undertaken to position the Company for future growth, reallocate resources to priority areas and, to a lesser extent, eliminate operational redundancy. These charges consisted primarily of severance benefits. As of October 31, 2018, there was an $8.1 million outstanding balance remaining in accounts payable and accrued liabilities in the consolidated balance sheets. The majority of remaining balance was paid in fiscal 2019.

During fiscal 2017, the Company recorded $36.6 million of restructuring charges for severance and benefits due to involuntary employee termination actions. The restructuring actions were undertaken to position the Company for future growth, reallocate resources to priority areas, and to a lesser extent, eliminate operational redundancy. These charges consist primarily of severance and retirement benefits. As of October 31, 2017, there was a $17.5 million outstanding balance remaining in accounts payable and accrued liabilities in the consolidated balance sheets, which was paid in fiscal 2018.

Accounts Payable and Accrued Liabilities. The balance consists of:

	October 31,	
	2019	2018
	(in thousands)	
Payroll and related benefits	$ 417,157	$ 413,307
Other accrued liabilities	69,487	79,973
Accounts payable	19,815	85,046
Total	$ 506,459	$ 578,326

Other Long-term Liabilities. The balance consists of:

	October 31,	
	2019	2018
	(in thousands)	
Deferred compensation liability (See *Note 10*)	$ 249,822	$ 212,165
Other long-term liabilities	73,903	53,395
Total	$ 323,725	$ 265,560

Other Comprehensive Income (Loss). Other comprehensive income (loss) (OCI) includes all changes in equity during a period, such as accumulated net translation adjustments, unrealized gain (loss) on certain foreign currency forward contracts that qualify as cash flow hedges, reclassification adjustments related to cash flow hedges and unrealized gain (loss) on investments. See *Note 8. Accumulated Other Comprehensive Income (Loss).*

Revenue Recognition. In May 2014, the Financial Accounting Standards Board (FASB) issued Accounting Standards Codification ASC 606 which supersedes the revenue recognition requirements in ASC 605. The new guidance creates a single, principle-based model for revenue recognition that is intended to expand and improve companies' revenue disclosures. For revenue recognition policies under ASC 605, refer to Note 2 - Summary of Significant Accounting Policies in the Company’s Annual Report on Form 10-K for the year ended October 31, 2018.

ASC 606 requires a company to recognize revenue when goods are transferred or services are provided to customers in an amount that reflects the consideration to which the company expects to be entitled to in exchange for those goods or services. ASC 606 also requires disclosures enabling users of financial statements to understand the nature, amount, timing, and uncertainty of revenue and cash flows arising from contracts with customers. The FASB has issued several amendments to ASC 606, including amendments that deferred the initially proposed adoption date and clarified accounting for licenses of intellectual property and identifying performance obligations.

The Company adopted ASC 606 at the beginning of fiscal 2019 using the modified retrospective transition method. Under this method, periods prior to the adoption date are not adjusted and continue to be reported under the revenue accounting literature in effect during those periods. The Company evaluated contracts that were in effect at the beginning of fiscal 2019 as if they had been accounted for under ASC 606 from the contract inception and summarized the most significant adoption impacts as follows:

- Revenue for certain ongoing contracts that was previously deferred would have been recognized in the periods prior to adoption under ASC 606. Therefore, upon adoption, the Company recorded the following adjustments to the beginning balances to reflect the amount of revenue that will no longer be recognized in future periods for such contracts: an increase to retained earnings of $265.1 million, a decrease to unbilled receivables of $27.4 million, an increase to contract assets of $126.9 million, and a decrease in deferred revenue of $165.6 million.
- The Company capitalized $73.8 million of incremental costs for obtaining contracts with customers at the adoption date with a corresponding adjustment to retained earnings and is amortizing these costs over the contract term.
- The Company recorded an increase in its opening deferred tax liability of $81.4 million, with a corresponding adjustment to retained earnings, to record the tax effect of the above adjustments.

The impacts of adopting ASC 606 on the Company's consolidated financial statements for fiscal 2019 are summarized in the tables below.

Balance Sheet Accounts

The following table summarizes the effects of adopting ASC 606 on certain account balances of the consolidated balance sheets that were impacted as of October 31, 2019:

	As reported under ASC 606	Adjustments	Adjusted balance under ASC 605
		(in thousands)	
Receivables, net	$ 553,895	$ 69,009	$ 622,904
Prepaid and other current assets	290,052	(210,557)	79,495
Deferred income taxes	390,129	83,191	473,320
Other long-term assets	380,526	(86,443)	294,083
Accounts payable and other accrued liabilities	506,459	(8,504)	497,955
Deferred revenue	1,212,476	171,641	1,384,117
Long-term deferred revenue	90,102	54,481	144,583
Other long-term liabilities (1)	323,725	(16,671)	307,054
Retained earnings	3,164,144	(345,747)	2,818,397

(1) Includes long-term deferred tax liabilities.

SYNOPSYS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS—Continued

Statements of Operations

The following table summarizes the effects of adopting ASC 606 on the consolidated statements of operations for fiscal 2019:

	Year Ended October 31, 2019		
	As reported under ASC 606	Adjustments	Adjusted under ASC 605
	(in thousands, except per share amounts)		
Revenue:			
Time-based products	$ 2,197,965	$ 206,904	$ 2,404,869
Upfront products	619,791	(235,398)	384,393
Maintenance and service	542,938	(74,037)	468,901
Total revenue	3,360,694	(102,531)	3,258,163
Cost of Revenue:			
Products	459,127	—	459,127
Maintenance and service	234,196	—	234,196
Amortization of intangible assets	59,623	—	59,623
Total cost of revenue	752,946	—	752,946
Gross margin	2,607,748	(102,531)	2,505,217
Operating expenses:			
Research and development	1,136,932	—	1,136,932
Sales and marketing	632,890	4,121	637,011
General and administrative	229,218	—	229,218
Amortization of intangible assets	41,291	—	41,291
Restructuring charges	47,186	—	47,186
Total operating expenses	2,087,517	4,121	2,091,638
Operating income	520,231	(106,652)	413,579
Other income (expense), net	25,275	—	25,275
Income before income taxes	545,506	(106,652)	438,854
Provision (benefit) for income taxes	13,139	(18,499)	(5,360)
Net income	$ 532,367	$ (88,153)	$ 444,214
Net income per share:			
Basic	$ 3.55	$ (0.59)	$ 2.96
Diluted	$ 3.45	$ (0.57)	$ 2.88
Shares used in computing per share amounts:			
Basic	149,872		149,872
Diluted	154,190		154,190

Statements of Cash Flows

Adoption of ASC 606 had no impact to cash from or used in operating, financing, or investing activities on the consolidated statements of cash flows.

Revenue Policy

The core principle of ASC 606 is to recognize revenue for the transfer of services or products to customers in an amount that reflects the consideration to which the Company expects to be entitled in exchange for those services or products. The principle is achieved through the following five-step approach:

- Identification of the contract, or contracts, with the customer
- Identification of the performance obligation in the contract
- Determination of the transaction price
- Allocation of the transaction price to the performance obligations in the contract
- Recognition of revenue when, or as, the Company satisfies a performance obligation

Nature of Products and Services

The Company generates revenue from the sale of products that include software licenses and, to a lesser extent, hardware products, maintenance and services. The various types are set forth below.

Electronic Design Automation

Software license revenue consists of fees associated with the licensing of the Company's software primarily through Technology Subscription License (TSL) contracts. TSLs are time-based licenses for a finite term and generally provide the customer with limited rights to receive, or to exchange certain quantities of licensed software for, unspecified future technology. The majority of the Company's arrangements are TSLs due to the nature of its business and customer requirements. In addition to the licenses, the arrangements also include: post-contract customer support, which includes providing frequent updates and upgrades to maintain the utility of the software due to rapid changes in technology; other intertwined services such as multiple copies of the tools; assisting the Company's customers in applying the Company's technology in the customers' development environment; and rights to remix licenses for other licenses. Payments are generally received in equal or near equal installments over the term of the arrangement. Under ASC 605, these arrangements were qualified to be recognized ratably over the contract terms. Under ASC 606, the Company has concluded that its software licenses in TSL contracts are not distinct from its obligation to provide unspecified software updates to the licensed software throughout the license term. Such updates represent inputs to a single, combined performance obligation, commencing upon the later of the arrangement effective date or transfer of the software license. Remix rights are not an additional promised good or service in the contract, and where unspecified additional software product rights are part of the contract with the customer, such rights are accounted for as part of the single performance obligation that includes the licenses, updates, and technical support because such rights are provided for the same period of time and have the same pattern of transfer to the customer over the duration of the subscription term.

IP & System Integration

The Company generally licenses IP under nonexclusive license agreements that provide usage rights for specific applications. Additionally, for certain IP license agreements, royalties are collected as customers sell their own products that incorporate the Company’s IP. Under ASC 605, the Company recognized revenue either upfront if certain criteria in ASC 605 were met, or over the contractual period for IP licensing and support arrangements if such arrangements were combined with other TSL arrangements. Under ASC 606, these arrangements generally have two distinct performance obligations that consist of transferring the licensed IP and the support service. Support services consist of a stand-ready obligation to provide technical support and software updates over the support term. Revenue allocated to the IP license is recognized at a point in time upon the later of the delivery date or the beginning of the license period, and revenue allocated to support services is recognized ratably over the support term. Royalties are recognized as revenue is earned, generally when the customer sells its products that incorporate the Company’s IP.

Software Integrity Products

Software Integrity product arrangements provide customers the right to software licenses, software updates and technical support. Under the term of these arrangements, the customer expects to receive integral updates to the software licenses that protect the customer's software from potential security vulnerabilities. The licenses and software updates together serve to fulfill the Company's commitment to the customer, as they represent inputs to a single, combined performance obligation that commences upon the later of the arrangement effective date or transfer of the software license. Software updates are part of the contract with the customer, and such rights are accounted for as part of the single performance obligation that includes the licenses, updates, and technical support because such rights are provided for the same period of time and have the same time-based pattern of transfer to the customer.

Hardware

The Company generally has two performance obligations in arrangements involving the sale of hardware products. The first performance obligation is to transfer the hardware product, which includes embedded software integral to the functionality of the hardware product. The second performance obligation is to provide maintenance on the hardware and its embedded software, including rights to technical support, hardware repairs and software updates that are all provided over the same term and have the same time-based pattern of transfer to the customer. The portion of the transaction price allocated to the hardware product is generally recognized as revenue at a point in time when the hardware is delivered to the customer. The Company has concluded that control generally transfers upon delivery because the customer has title to the hardware, physical possession of the hardware, and a present obligation to pay for the hardware. The portion of the transaction price allocated to maintenance is recognized as revenue that is ratable over the maintenance term. The adoption of ASC 606 did not change the timing of revenue recognition for hardware products and related services.

Professional Services

The Company's arrangements often include service elements (other than maintenance and support services). These services include training, design assistance, and consulting. Services performed on a time and materials basis are recognized over time, as the customer simultaneously receives and consumes the benefit provided. Certain arrangements also include the customization or modification of licensed IP. Revenue from these contracts is recognized over time as the services are performed, when the development is specific to the customer's needs and Synopsys has enforceable rights to payment for performance completed. Performance is generally measured using costs incurred or hours expended to measure progress. The Company has a history of accurately estimating project status and the costs necessary to complete projects. A number of internal and external factors can affect these estimates, including labor rates, utilization and efficiency variances, specification and testing requirement changes, and changes in customer delivery priorities. Payments for services are generally due upon milestones in the contract or upon consumption of the hourly resources.

Flexible Spending Accounts

Some customers enter into a non-cancelable Flexible Spending Account arrangement (FSA) whereby the customer commits to a fixed dollar amount over a specified period of time that can be used to purchase from a list of Synopsys products or services. These arrangements do not meet the definition of a revenue contract until the customer executes a separate order to identify the required products and services that they are purchasing. The combination of the FSA arrangement and the subsequent order creates enforceable rights and obligations, thus meeting the definition of a revenue contract. Each separate order under the agreement is treated as an individual contract under the new standard and accounted for based on the respective performance obligations included within the FSA arrangements.

Disaggregated Revenue

The following table shows the percentage of revenue by product groups:

	Year Ended October 31,		
	2019	2018	2017
EDA	59%	62%	66%
IP & System Integration	31%	29%	28%
Software Integrity Products & Services	10%	9%	6%
Other	—%	—%	—%
Total	100%	100%	100%

Judgments

The Company's contracts with customers often include promises to transfer multiple products and services to a customer. Determining whether services and products are considered distinct performance obligations that should be accounted for separately versus together requires significant judgment. The Company has concluded that (1) its EDA software licenses in TSL contracts are not distinct from its obligation to provide unspecified software updates to the licensed software throughout the license term, because those promises represent inputs to a single, combined performance obligation, and (2) where unspecified additional software product rights are part of the contract with the customer, such rights are accounted for as part of the single performance obligation that includes the licenses, updates, and technical support, because such rights are provided for the same period of time and have the same time-based pattern of transfer to the customer. In reaching this conclusion, the Company considered the nature of the obligation to customers which is to provide an ongoing right to use the most up to date and relevant software. As EDA customers operate in a rapidly changing and competitive environment, satisfying the obligation requires providing critical updates to the existing software products, including ongoing iterative interaction with customers to make the software relevant to customers' ability to meet the time to go to market with advanced products.

Similarly, the Company also concluded that in its Software Integrity business, the licenses and maintenance updates serve together to fulfill the Company's commitment to the customer as both work together to provide the functionality to the customer and represent a combined performance obligation because the updates are essential to the software's central utility, which is to identify security vulnerabilities and other threats.

Judgment is also required to determine the standalone selling price (SSP) for each distinct performance obligation. For non-software performance obligations (IP, Hardware, and services), SSP is established based on observable prices of products and services sold separately. SSP for license (and related updates and support) in a contract with multiple performance obligations is determined by applying a residual approach whereby all other non-software performance obligations within a contract are first allocated a portion of the transaction price based upon their respective SSP, using observable prices, with any residual amount of the transaction price allocated to the license because the Company does not sell the license separately, and the pricing is highly variable.

Contract Balances

The timing of revenue recognition may differ from the timing of invoicing to customers, and these timing differences result in receivables (billed or unbilled), contract assets, or contract liabilities (deferred revenue) on the Company's consolidated balance sheet. The Company records a contract asset when revenue is recognized prior to the right to invoice, or deferred revenue when revenue is recognized subsequent to invoicing. For time-based software agreements, customers are generally invoiced in equal, quarterly amounts, although some customers prefer to be invoiced in single or annual amounts. The Company records an unbilled receivable when revenue is recognized and it has an unconditional right to invoice and receive payment.

The contract assets indicated below are presented as prepaid and other current assets in the consolidated balance sheet. The contract assets are transferred to receivables when the rights to invoice and receive payment become unconditional.

Contract balances are as follows:

	Balance as of October 31, 2019	Balance as of October 31, 2018
		as adjusted
	(in thousands)	
Contract assets	$ 210,557	$ 126,897
Unbilled receivables	38,175	36,699
Deferred revenue	1,302,578	1,104,110

During fiscal 2019, the Company recognized approximately $1 billion of revenue that was included in the deferred revenue balance at the beginning of the period, as adjusted for the adoption of ASC 606.

Contracted but unsatisfied or partially unsatisfied performance obligations were approximately $4.4 billion as of October 31, 2019, which includes $494.3 million in non-cancellable FSA commitments from customers where actual product selection and quantities of specific products or services are to be determined by customers at a later date. The Company has elected to exclude future sales-based royalty payments from the remaining performance obligations. The contracted but unsatisfied or partially unsatisfied performance obligations, excluding non-cancellable FSA, expected to be recognized over the next 12 months is approximately 56%, with the remainder recognized thereafter.

During fiscal 2019, the Company recognized $80.0 million from performance obligations satisfied from sales based royalties earned during the periods.

Costs of Obtaining a Contract with Customer

The incremental costs of obtaining a contract with a customer, which consist primarily of direct sales commissions earned upon execution of the contract, are required to be capitalized under ASC 340-40 and amortized over the estimated period of which the benefit is expected to be received. As direct sales commissions paid for renewals are commensurate with the amounts paid for initial contracts, the deferred incremental costs will be recognized over the contract term. Total capitalized direct commission costs as of October 31, 2019 were $86.4 million and are included in other assets in the Company's consolidated balance sheet. Amortization of these assets was $62.8 million during fiscal 2019 and is included in sales and marketing expense in the Company's consolidated statements of operations.

Warranties and Indemnities. The Company generally warrants its products to be free from defects in media and to substantially conform to material specifications for a period of 90 days for software products and for up to six months for hardware systems. In certain cases, the Company also provides its customers with limited indemnification with respect to claims that their use of the Company's software products infringes on United States patents, copyrights, trademarks or trade secrets. The Company is unable to estimate the potential impact of these commitments on the future results of operations. To date, the Company has not been required to pay any material warranty claims.

Net Income Per Share. The Company computes basic income per share by dividing net income available to common shareholders by the weighted average number of common shares outstanding during the period. Diluted net income per share reflects the dilution from potential common shares outstanding such as stock options and unvested restricted stock units and awards during the period using the treasury stock method.

The table below reconciles the weighted average common shares used to calculate basic net income per share with the weighted average common shares used to calculate diluted net income per share:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands, except per share amounts)		
Numerator:			
Net income	$ 532,367	$ 432,518	$ 136,563
Denominator:			
Weighted average common shares for basic net income per share	149,872	149,036	150,457
Dilutive effect of common share equivalents from equity-based compensation	4,318	4,357	4,417
Weighted average common shares for diluted net income per share	154,190	153,393	154,874
Net income per share:			
Basic	$ 3.55	$ 2.90	$ 0.91
Diluted	$ 3.45	$ 2.82	$ 0.88
Anti-dilutive employee stock-based awards excluded(1)	171	850	345

(1) These stock options and unvested restricted stock units were anti-dilutive for the respective periods and are excluded in calculating diluted net income per share. While such awards were anti-dilutive for the respective periods, they could be dilutive in the future.

Note 3. Business Combinations

Fiscal 2018 Acquisitions

During fiscal 2018, the Company completed several acquisitions for $637.0 million of aggregate cash consideration, net of cash, cash equivalents and short-term investments acquired. The Company does not consider these acquisitions to be material, individually or in the aggregate, to the Company's consolidated statements of operations.

Acquisition of Black Duck Software (Black Duck)

On December 11, 2017, the Company acquired 100% of the outstanding shares of Black Duck, a privately-held leader in automated solutions for securing and managing open source software, for $565.1 million of total purchase consideration.

The total purchase consideration and the purchase price allocation was as follows:

	(in thousands)
Cash paid	$ 563,500
Fair value of assumed equity awards allocated to purchase consideration	1,588
Total purchase consideration	$ 565,088
Goodwill	$ 395,395
Identifiable intangibles assets acquired	178,000
Cash, cash equivalents and short-term investments	19,491
Other tangible liabilities acquired, net	(12,298)
Deferred revenue	(15,500)
Total purchase price allocation	$ 565,088

Goodwill of $395.4 million is primarily attributable to the assembled workforce and expectation of sales growth due to the Company's new technology offerings in the security, quality and compliance testing space. Goodwill is not deductible for tax purposes. The acquired identifiable intangible assets of $178.0 million were valued using the income or cost methods. Intangible assets, except for in-process research and development project not yet completed, are being amortized over their respective useful lives ranging from one to ten years. Acquisition-related costs directly attributable to the business combination of $15.5 million, including compensation expenses, professional fees and other direct expenses, were expensed as incurred in the consolidated statements of operations during fiscal year 2018. The Company funded the acquisition with cash of $544.0 million, net of acquired cash, cash equivalents and short-term investments.

The Company also assumed unvested restricted stock units (RSUs) and stock options with a fair value of $15.6 million. The Black-Scholes option-pricing model was used to determine the fair value of these stock options, whereas the fair value of the RSUs was based on the market price on the grant date of the instruments. Of the total fair value of the RSU and stock options assumed, $1.6 million was allocated to the purchase consideration and $14.0 million was allocated to future services to be expensed over their remaining service periods on a straight-line basis.

Other Fiscal 2018 Acquisitions

During fiscal 2018, the Company completed other acquisitions for $93.0 million of total purchase consideration, net of cash acquired. The Company does not consider these acquisitions to be material to the Company's consolidated financial statements. The preliminary purchase price allocations resulted in $47.6 million of goodwill, which is not deductible for tax purposes, and $51.9 million of acquired identifiable intangible assets valued using the income or cost methods. Intangible assets, except for in-process research and development projects not yet completed, are being amortized over their respective useful lives ranging from one to seven years. Acquisition-related costs for these acquisitions, totaling $3.8 million, were expensed as incurred in the consolidated statements of operations.

Note 4. Goodwill and Intangible Assets

Following the realignment of the Company's operating segments during the first quarter of fiscal 2019, as described in *Note 13. Segment Disclosure,* the Company has two reporting units and has assigned assets and liabilities to each of the reporting units based on each unit's operating activities. Previously, the Company operated as a single reporting segment and reporting unit. Goodwill was reallocated to the reporting units using the relative fair value method and assessed for impairment. No impairment of goodwill was identified for any periods presented.

Goodwill activity by reportable segment for the year ended October 31, 2019 consists of the following:

	Semiconductor & System Design	Software Integrity	Total
		(in thousands)	
Balance at October 31, 2018	$ 2,730,990	$ 412,259	$ 3,143,249
Additions	23,690	—	23,690
Effect of foreign currency translation	4,246	(6)	4,240
Balance at October 31, 2019	$ 2,758,926	$ 412,253	$ 3,171,179

Goodwill activity for the year ended October 31, 2018 consists of the following:

	(in thousands)
Balance at October 31, 2017	$ 2,706,974
Additions	443,007
Effect of foreign currency translation	(6,732)
Balance at October 31, 2018	$ 3,143,249

Intangible assets as of October 31, 2019 consist of the following:

	Gross Assets	Accumulated Amortization	Net Assets
		(in thousands)	
Core/developed technology	$ 791,647	$ 655,119	$ 136,528
Customer relationships	358,661	242,058	116,603
Contract rights intangible	184,304	181,124	3,180
Trademarks and trade names	42,929	25,581	17,348
In-process research and development (IPR&D)	1,200	—	1,200
Capitalized software development costs	40,077	35,562	4,515
Total	$ 1,418,818	$ 1,139,444	$ 279,374

Intangible assets as of October 31, 2018 consist of the following:

	Gross Assets	Accumulated Amortization	Net Assets
		(in thousands)	
Core/developed technology	$ 773,147	$ 598,956	$ 174,191
Customer relationships	358,524	204,382	154,142
Contract rights intangible	183,953	177,191	6,762
Trademarks and trade names	42,929	21,944	20,985
In-process research and development (IPR&D)	1,200	—	1,200
Capitalized software development costs	35,818	32,694	3,124
Total	$ 1,395,571	$ 1,035,167	$ 360,404

Amortization expense related to intangible assets consisted of the following:

	Year Ended October 31,		
	2019	2018	2017
		(in thousands)	
Core/developed technology	$ 56,163	$ 78,820	$ 65,916
Customer relationships	37,533	37,395	27,340
Contract rights intangible	3,581	4,906	10,886
Trademarks and trade names	3,637	4,543	3,580
Capitalized software development costs(1)	2,868	3,599	3,986
Total	$ 103,782	$ 129,263	$ 111,708

(1) Amortization of capitalized software development costs is included in cost of products revenue in the consolidated statements of operations.

The following table presents the estimated future amortization of intangible assets as of October 31, 2019:

Fiscal Year	(in thousands)
2020	$ 83,899
2021	61,113
2022	47,713
2023	32,919
2024	23,797
2025 and thereafter	28,733
IPR&D	1,200
Total	$ 279,374

Note 5. Financial Assets and Liabilities

Cash equivalents. The Company classifies time deposits and other investments with original maturities less than three months as cash equivalents.

As of October 31, 2019, the balances of the Company's cash equivalents and non-marketable equity securities investments were:

	Cost	Gross Unrealized Gains	Gross Unrealized Losses Less Than 12 Continuous Months	Gross Unrealized Losses 12 Continuous Months or Longer	Estimated Fair Value(1)
			(in thousands)		
Cash equivalents:					
Money market funds	$ 166,024	$ —	$ —	$ —	$ 166,024
Total:	$ 166,024	$ —	$ —	$ —	$ 166,024
Other long-term assets:					
Non-marketable equity securities	$ 10,951	$ —	$ —	$ —	$ 10,951
Total:	$ 10,951	$ —	$ —	$ —	$ 10,951

(1) See *Note 6. Fair Value Measures* for further discussion on fair values of cash equivalents.

As of October 31, 2018, the balances of our cash equivalents and non-marketable equity securities investments were:

	Cost	Gross Unrealized Gains	Gross Unrealized Losses Less Than 12 Continuous Months	Gross Unrealized Losses 12 Continuous Months or Longer	Estimated Fair Value(1)
			(in thousands)		
Cash equivalents:					
Money market funds	$ 165,296	$ —	$ —	$ —	$ 165,296
Total:	$ 165,296	$ —	$ —	$ —	$ 165,296
Other long-term assets:					
Non-marketable equity securities	$ 10,892	$ —	$ —	$ —	$ 10,892
Total:	$ 10,892	$ —	$ —	$ —	$ 10,892

(1) See *Note 6. Fair Value Measures* for further discussion on fair values of cash equivalents.

Restricted cash. In November 2016, the FASB issued ASU 2016-18, “Statement of Cash Flows (Topic 230): Restricted Cash.” The Company adopted the standard in the first quarter of fiscal 2019 and applied it retrospectively for the periods presented. As required by ASU 2016-18, the Company included amounts generally described as restricted cash and restricted cash equivalents in cash and cash equivalents when reconciling beginning-of-period and end-of-period total amounts shown on the consolidated statements of cash flows. All restricted cash is primarily associated with office leases and has no material impact on the Company’s consolidated statements of cash flows.

The following table provides a reconciliation of cash, cash equivalents and restricted cash included in the consolidated balance sheets:

	October 31,	
	2019	2018
	(in thousands)	
Cash and cash equivalents	$ 728,597	$ 723,115
Restricted cash included in Prepaid expenses and other current assets	1,174	1,164
Restricted cash included in Other long-term assets	756	722
Total cash, cash equivalents and restricted cash	$ 730,527	$ 725,001

Non-marketable equity securities. The Company's strategic investment portfolio consists of non-marketable equity securities in privately held companies. The securities accounted for as cost method investments are reported at cost, net of impairment losses. Securities accounted for as equity method investments are recorded at cost plus the proportional share of the issuers' income or loss, which is recorded in the Company's other income (expense), net. The cost basis of securities sold is based on the specific identification method. Refer to *Note 6. Fair Value Measures.*

Derivatives. The Company recognizes derivative instruments as either assets or liabilities in the consolidated financial statements at fair value and provides qualitative and quantitative disclosures about such derivatives. The Company operates internationally and is exposed to potentially adverse movements in foreign currency exchange rates. The Company enters into hedges in the form of foreign currency forward contracts to reduce its exposure to foreign currency rate changes on non-functional currency denominated forecasted transactions and balance sheet positions including: (1) certain assets and liabilities, (2) shipments forecasted to occur within approximately one month, (3) future billings and revenue on previously shipped orders, and (4) certain future intercompany invoices denominated in foreign currencies.

The duration of forward contracts ranges from approximately one month to 22 months, the majority of which are short-term. The Company does not use foreign currency forward contracts for speculative or trading purposes. The Company enters into foreign exchange forward contracts with high credit quality financial institutions that are rated 'A' or above and to date has not experienced nonperformance by counterparties. Further, the Company anticipates continued performance by all counterparties to such agreements.

The assets or liabilities associated with the forward contracts are recorded at fair value in other current assets or accrued liabilities in the consolidated balance sheets. The accounting for gains and losses resulting from changes in fair value depends on the use of the foreign currency forward contract and whether it is designated and qualifies for hedge accounting.

Cash Flow Hedging Activities

Certain foreign exchange forward contracts are designated and qualify as cash flow hedges. These contracts have durations of approximately 22 months or less. Certain forward contracts are rolled over periodically to capture the full length of exposure to the Company's foreign currency risk, which can be up to three years. To receive hedge accounting treatment, all hedging relationships are formally documented at the inception of the hedge, and the hedges must be highly effective in offsetting changes to future cash flows on the hedged transactions. The effective portion of gains or losses resulting from changes in fair value of these hedges is initially reported, net of tax, as a component of other comprehensive income (loss) (OCI), in stockholders' equity and reclassified into revenue or operating expenses, as appropriate, at the time the hedged transactions affect earnings. The Company expects a majority of the hedge balance in OCI to be reclassified to the statements of operations within the next twelve months.

Hedging effectiveness is evaluated monthly using spot rates, with any gain or loss caused by hedging ineffectiveness recorded in other income (expense), net. The premium/discount component of the forward contracts is recorded to other income (expense), net, and is not included in evaluating hedging effectiveness.

Non-designated Hedging Activities

The Company's foreign exchange forward contracts that are used to hedge non-functional currency denominated balance sheet assets and liabilities are not designated as hedging instruments. Accordingly, any gains or losses from changes in the fair value of the forward contracts are recorded in other income (expense), net. The gains and losses on these forward contracts generally offset the gains and losses associated with the underlying assets and liabilities, which are also recorded in other income (expense), net. The duration of the forward contracts for hedging the Company's balance sheet exposure is approximately one month.

The Company also has certain foreign exchange forward contracts for hedging certain international revenues and expenses that are not designated as hedging instruments. Accordingly, any gains or losses from changes in the fair value of the forward contracts are recorded in other income (expense), net. The gains and losses on these forward contracts generally offset the gains and losses associated with the foreign currency in operating income. The duration of these forward contracts is usually less than one year. The overall goal of the Company's hedging program is to minimize the impact of currency fluctuations on its net income over its fiscal year.

The effects of the changes in the fair values of non-designated forward contracts for fiscal years 2019, 2018, and 2017 are summarized as follows:

	October 31,		
	2019	2018	2017
	(in thousands)		
Gain (loss) recorded in other income (expense), net	$ 4,538	$ 3,361	$ 1,359

The notional amounts in the table below for derivative instruments provide one measure of the transaction volume outstanding:

	October 31,	
	2019	2018
	(in thousands)	
Total gross notional amount	$ 817,441	$ 1,135,549
Net fair value	$ 3,494	$ (18,120)

The notional amounts for derivative instruments do not represent the amount of the Company's exposure to market gain or loss. The Company's exposure to market gain or loss will vary over time as a function of currency exchange rates. The amounts ultimately realized upon settlement of these financial instruments, together with the gains and losses on the underlying exposures, will depend on actual market conditions during the remaining life of the instruments.

The following table represents the balance sheet location and amount of derivative instrument fair values segregated between designated and non-designated hedge instruments:

	Fair Values of derivative instruments designated as hedging instruments	Fair Values of derivative instruments not designated as hedging instruments
	(in thousands)	
As of October 31, 2019		
Other current assets	$ 7,327	$ 53
Accrued liabilities	$ 3,715	$ 171
As of October 31, 2018		
Other current assets	$ 4,771	$ 131
Accrued liabilities	$ 22,890	$ 132

The following table represents the consolidated statements of operations location and amount of gains and losses on derivative instrument fair values for designated hedge instruments, net of tax:

	Location of gain (loss) recognized in OCI on derivatives	Amount of gain (loss) recognized in OCI on derivatives (effective portion)	Location of gain (loss) reclassified from OCI	Amount of gain (loss) reclassified from OCI (effective portion)
		(in thousands)		
Fiscal year ended October 31, 2019				
Foreign exchange contracts	Revenue	$ 278	Revenue	$ 1,436
Foreign exchange contracts	Operating expenses	4,455	Operating expenses	(16,073)
Total		$ 4,733		$ (14,637)
Fiscal year ended October 31, 2018				
Foreign exchange contracts	Revenue	$ 693	Revenue	$ 1,103
Foreign exchange contracts	Operating expenses	(18,121)	Operating expenses	9,785
Total		$ (17,428)		$ 10,888
Fiscal year ended October 31, 2017				
Foreign exchange contracts	Revenue	$ 7,582	Revenue	$ (2,759)
Foreign exchange contracts	Operating expenses	13,346	Operating expenses	(805)
Total		$ 20,928		$ (3,564)

The following table represents the ineffective portions and portions excluded from effectiveness testing of the hedge gains (losses) for derivative instruments designated as hedging instruments, which are recorded in other income (expense) income, net:

Foreign exchange contracts	Amount of gain (loss) recognized in statement of operations on derivatives (ineffective portion)(1)	Amount of gain (loss) recognized in income statement on derivatives (excluded from effectiveness testing)(2)
	(in thousands)	
Fiscal year ended October 31, 2019	$ 575	$ 1,052
Fiscal year ended October 31, 2018	$ 467	$ 2,848
Fiscal year ended October 31, 2017	$ 311	$ 3,018

(1) The ineffective portion includes forecast inaccuracies.
(2) The portion excluded from effectiveness testing includes the discount earned or premium paid for the contracts.

Other Commitments— Credit and Term Loan Facilities

In July 2018, the Company entered into a 220.0 million RMB (approximately $33.0 million) credit agreement with a lender in China to support its facilities expansion. Borrowings bear interest at a floating rate based on the Chinese Central Bank rate plus 10% of such rate. As of October 31, 2019, the Company had $17.9 million outstanding under the agreement.

On November 28, 2016, the Company entered into an amended and restated credit agreement with several lenders (the Credit Agreement) providing for (i) a $650.0 million senior unsecured revolving credit facility (the Revolver) and (ii) a $150.0 million senior unsecured term loan facility (the Term Loan). The Credit Agreement amended and restated the Company's previous credit agreement dated May 19, 2015, in order to increase the size of the revolving credit facility from $500.0 million to $650.0 million, provide a new $150.0 million senior unsecured term loan facility, and to extend the termination date of the revolving credit facility from May 19, 2020 to November 28, 2021. Subject to obtaining additional commitments from lenders, the principal amount of the loans provided under the Credit Agreement may be increased by the Company by up to an additional $150.0 million. The Credit Agreement contains financial covenants requiring the Company to operate within a maximum leverage ratio and maintain a minimum interest coverage ratio, as well as other non-financial covenants. As of October 31, 2019, the Company was in compliance with all financial covenants.

As of October 31, 2019, the Company had $119.8 million outstanding balance, net of debt issuance costs, under the Term Loan, of which $102.2 million was classified as long-term liabilities. Outstanding principal payments under the Term Loan are due as follows:

Fiscal year		(in thousands)
2020	$	17,813
2021		27,187
2022		75,000
Total	$	120,000

As of October 31, 2018, the Company had $133.8 million outstanding balance, net of debt issuance costs, under the Term Loan, of which $120.0 million was classified as long-term liabilities. The total outstanding balance under the Revolver as of October 31, 2018 was $330.0 million, which was included in short-term liabilities.

There was no outstanding balance under the Revolver as of October 31, 2019. The Company expects its borrowings under the Revolver will fluctuate from quarter to quarter. Borrowings bear interest at a floating rate based on a margin over the Company's choice of market observable base rates as defined in the Credit Agreement. As of October 31, 2019, borrowings under the Term Loan bore interest at LIBOR +1.125% and the applicable interest rate for the Revolver was LIBOR +1.000%. In addition, commitment fees are payable on the Revolver at rates between 0.125% and 0.200% per year based on the Company's leverage ratio on the daily amount of the revolving commitment.

Subsequent to fiscal year 2019, the Company drew down $160.0 million under the Revolver. The total outstanding balance of the Revolver as of December 20, 2019 is $160.0 million, net of repayments.

The carrying amount of the short-term and long-term debt approximates the estimated fair value. These borrowings under the Credit Agreement have a variable interest rate structure and are classified within Level 2 of the fair value hierarchy.

Note 6. Fair Value Measures

Accounting Standards Codification (ASC) 820-10, *Fair Value Measurements and Disclosures*, defines fair value, establishes guidelines and enhances disclosure requirements for fair value measurements. The accounting guidance requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. The accounting guidance also establishes a fair value hierarchy based on the independence of the source and objective evidence of the inputs used. There are three fair value hierarchies based upon the level of inputs that are significant to fair value measurement:

Level 1—Observable inputs that reflect quoted prices (unadjusted) for identical instruments in active markets;

Level 2—Observable inputs other than quoted prices included in Level 1 for similar instruments in active markets, quoted prices for identical or similar instruments in markets that are not active, and model-driven valuations in which all significant inputs and significant value drivers are observable in active markets; and

Level 3—Unobservable inputs to the valuation derived from fair valuation techniques in which one or more significant inputs or significant value drivers are unobservable.

On a recurring basis, the Company measures the fair value of certain of its assets and liabilities, which include cash equivalents, non-qualified deferred compensation plan assets, and foreign currency derivative contracts.

The Company's cash equivalents are classified within Level 1 or Level 2 because they are valued using quoted market prices in an active market or alternative independent pricing sources and models utilizing market observable inputs.

The Company's non-qualified deferred compensation plan assets consist of money market and mutual funds invested in domestic and international marketable securities that are directly observable in active markets and are therefore classified within Level 1.

The Company's foreign currency derivative contracts are classified within Level 2 because these contracts are not actively traded and the valuation inputs are based on quoted prices and market observable data of similar instruments.

The Company's borrowings under its credit and term loan facilities are classified within Level 2 because these borrowings are not actively traded and have a variable interest rate structure based upon market rates currently available to the Company for debt with similar terms and maturities. See *Note 5. Financial Assets and Liabilities* for more information on these borrowings.

Assets/Liabilities Measured at Fair Value on a Recurring Basis

Assets and liabilities measured at fair value on a recurring basis are summarized below as of October 31, 2019:

		Fair Value Measurement Using		
Description	Total	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
		(in thousands)		
Assets				
Cash equivalents:				
Money market funds	$ 166,024	$ 166,024	$ —	$ —
Prepaid and other current assets:				
Foreign currency derivative contracts	7,380	—	7,380	—
Other long-term assets:				
Deferred compensation plan assets	249,822	249,822	—	—
Total assets	$ 423,226	$ 415,846	$ 7,380	$ —
Liabilities				
Accounts payable and accrued liabilities:				
Foreign currency derivative contracts	$ 3,886	$ —	$ 3,886	$ —
Other long-term liabilities:				
Deferred compensation plan liabilities	249,822	249,822	—	—
Total liabilities	$ 253,708	$ 249,822	$ 3,886	$ —

Assets and liabilities measured at fair value on a recurring basis are summarized below as of October 31, 2018:

Description	Total	Fair Value Measurement Using: Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
		(in thousands)		
Assets				
Cash equivalents:				
Money market funds	$ 165,296	$ 165,296	$ —	$ —
Prepaid and other current assets:				
Foreign currency derivative contracts	4,902	—	4,902	—
Other long-term assets:				
Deferred compensation plan assets	212,165	212,165	—	—
Total assets	$ 382,363	$ 377,461	$ 4,902	$ —
Liabilities				
Accounts payable and accrued liabilities:				
Foreign currency derivative contracts	$ 23,022	$ —	$ 23,022	$ —
Other long-term liabilities:				
Deferred compensation plan liabilities	212,165	212,165	—	—
Total liabilities	$ 235,187	$ 212,165	$ 23,022	$ —

Assets/Liabilities Measured at Fair Value on a Non-Recurring Basis

Non-Marketable Equity Securities

Equity investments in privately-held companies, also called non-marketable equity securities, are accounted for using either the cost or equity method of accounting.

The non-marketable equity securities are measured and recorded at fair value when an event or circumstance which impacts the fair value of these securities indicates an other-than-temporary decline in value has occurred. In such events, these equity investments would be classified within Level 3 as they are valued using significant unobservable inputs or data in an inactive market, and the valuation requires management judgment due to the absence of market price and inherent lack of liquidity. The Company monitors these investments and generally uses the income approach to assess impairments based primarily on the financial conditions of these companies.

The Company did not recognize any impairment during fiscal 2019 and 2018. The Company recorded $1.3 million of other-than-temporary impairment during fiscal 2017.

The following table presents the non-marketable equity securities that were measured and recorded at fair value within other long-term assets on a non-recurring basis and the loss recorded in other income (expense), net:

	Balance as of October 31, 2017	Significant Unobservable Inputs (Level 3)	Total (losses) for Fiscal 2017
		(in thousands)	
Non-marketable equity securities	$ —	$ —	$ (1,300)

Note 7. Commitments and Contingencies

Lease Commitments

The Company leases certain of its domestic and foreign facilities and certain office equipment under non-cancelable lease agreements. The lease agreements generally require the Company to pay property taxes, insurance, maintenance and repair costs. Rent expenses were $91.3 million, $75.7 million and $68.1 million in fiscal 2019, 2018 and 2017, respectively. The Company records operating lease payments to expense using the straight-line method and records sublease payments as a reduction of rent expense.

The Company's principal offices are located in two adjacent buildings in Mountain View, California, which together provide approximately 341,000 square feet of available space. This space is leased through August 2030, and the Company has two options to extend the lease term, the first to extend the term by ten years, followed by a second option to extend by approximately nine additional years.

As of October 31, 2019, anticipated future minimum lease payments on all non-cancellable operating leases with an initial term in excess of one year are as follows:

	Minimum Lease Payments	
	(in thousands)	
Fiscal Year		
2020	$	79,286
2021		79,703
2022		69,477
2023		53,909
2024		48,730
Thereafter		291,494
Total	$	622,599

Legal Proceedings

The Company is subject to routine legal proceedings, as well as demands, claims and threatened litigation that arise in the normal course of its business. The ultimate outcome of any litigation is often uncertain and unfavorable outcomes could have a negative impact on the Company’s results of operations and financial condition. The Company regularly reviews the status of each significant matter and assesses its potential financial exposure. If the potential loss from any claim or legal proceeding is considered probable and the amount is estimable, the Company accrues a liability for the estimated loss. Legal proceedings are inherently uncertain and as circumstances change, it is possible that the amount of any accrued liability may increase, decrease, or be eliminated.

The Company has determined that, except as set forth below, no disclosure of estimated loss is required for a claim against the Company because: (1) there is not a reasonable possibility that a loss exceeding amounts already recognized (if any) may be incurred with respect to such claim; (2) a reasonably possible loss or range of loss cannot be estimated; or (3) such estimate is immaterial.

Mentor Patent Litigation Prior to the legal settlement as further described below, the Company was engaged in complex patent litigation with Mentor Graphics Corporation (Mentor) involving several actions in different forums. The Company succeeded to the litigation when it acquired Emulation & Verification Engineering S.A. on October 4, 2012.

Legal Settlement

In March 2017, Siemens PLM Software (Siemens) acquired Mentor. On June 29, 2018, the Company, Siemens and Mentor settled all outstanding patent litigation between the Company and Mentor for a $65.0 million payment made in the current quarter from the Company to Mentor. The Company had previously accrued $39.0 million and recorded the remaining $26.0 million as an expense in the quarter ended July 31, 2018. As a result of the settlement, the litigation with Mentor was dismissed and the injunction entered in connection with that litigation was vacated.The settlement included mutual seven-year patent cross-licenses between the Company and Siemens, and between the Company and Mentor. The Company and Mentor also amended an existing interoperability agreement to collaborate on a wide range of EDA products for the benefit of their mutual customers. The amendment includes a one-time termination charge between $0.0 and $25.0 million, payable to Mentor under certain conditions.

Tax Matters

The Company undergoes examination from time to time by U.S. and foreign authorities for non-income based taxes, such as sales, use and value-added taxes, and is currently under examination by tax authorities in certain jurisdictions. If the potential loss from such examinations is considered probable and the amount or the range of loss could be estimated, the Company would accrue a liability for the estimated expense. In addition to the foregoing, the Company is, from time to time, party to various other claims and legal proceedings in the ordinary course of its business, including with tax and other governmental authorities. For a description of certain of these other matters, refer to *Note 11. Income Taxes.*

Note 8. Accumulated Other Comprehensive Income (Loss)

Components of accumulated other comprehensive income (loss), on an after-tax basis where applicable, were as follows:

	Year Ended October 31,	
	2019	2018
	(in thousands)	
Cumulative currency translation adjustments	$ (87,929)	$ (89,289)
Unrealized gain (loss) on derivative instruments, net of taxes	(4,518)	(23,888)
Total accumulated other comprehensive income (loss)	$ (92,447)	$ (113,177)

The effect of amounts reclassified out of each component of accumulated other comprehensive income (loss) into net income was as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Reclassifications from accumulated other comprehensive income (loss) into consolidated statements of operations:			
Gain (loss) on cash flow hedges, net of taxes			
Revenues	$ 1,436	$ 1,103	$ (2,759)
Operating expenses	(16,073)	9,785	(805)
Gain (loss) on available-for-sale securities			
Other income (expense)	—	—	(8)
Total reclassifications into net income	$ (14,637)	$ 10,888	$ (3,572)

Amounts reclassified in fiscal 2019, 2018, and 2017 primarily consisted of gains (losses) from the Company’s cash flow hedging activities. See *Note 5. Financial Assets and Liabilities.*

Note 9. Stock Repurchase Program

The Company's Board of Directors (Board) previously approved a stock repurchase program pursuant to which the Company was authorized to purchase up to $500.0 million of its common stock, and has periodically replenished the stock repurchase program to such amount. The Board replenished the stock repurchase program up to $500.0 million on June 14, 2019. The program does not obligate the Company to acquire any particular amount of common stock, and the program may be suspended or terminated at any time by the Company's Chief Financial Officer or the Board. The Company repurchases shares to offset dilution caused by ongoing stock issuances from existing equity plans for equity compensation awards and issuances related to acquisitions, and when management believes it is a good use of cash. Repurchases are transacted in accordance with Rule 10b-18 of the Securities Exchange Act of 1934, as amended (the Exchange Act) and may be made through any means including, but not limited to, open market purchases, plans executed under Rule 10b5-1(c) of the Exchange Act and structured transactions. As of October 31, 2019, $400 million remained available for future repurchases under the program.

In December 2019, the Company entered an accelerated share repurchase agreements (the December 2019 ASR) to repurchase an aggregate of $100.0 million of the Company's common stock. Pursuant to the December 2019 ASR, the Company will make a prepayment of $100.0 million to receive initial share deliveries of shares valued at $80.0 million. The remaining balance of $20.0 million is anticipated to be settled on or before February 27, 2020, upon completion of the repurchase. Under the terms of the December 2019 ASR, the specific number of shares that the Company ultimately repurchase will be based on the volume-weighted average share price of the Company's common stock during the repurchase period, less a discount.

Stock repurchase activities as well as the reissuance of treasury stock for employee stock-based compensation purposes are as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands, except per share price)		
Shares repurchased(1)	2,732	4,688	5,413
Average purchase price per share(1)	$ 120.49	$ 89.59	$ 70.21
Aggregate purchase price(1)	$ 329,185	$ 420,000	$ 380,000
Reissuance of treasury stock	3,798	3,508	4,404

(1) The first quarter of fiscal 2018 includes the settlement of the $20.0 million equity forward contract related to the September 2017 ASR.

Note 10. Employee Benefit Plans

Employee Stock Purchase Plan

Under the Company's Employee Stock Purchase Plan (ESPP), participating employees are granted the right to purchase shares of common stock at a price per share that is 85% of the lesser of the fair market value of the shares at (1) the beginning of an offering period (generally, a rolling two year period) or (2) the purchase date (generally occurring at the end of each semi-annual purchase period), subject to the terms of the plan, including a plan limit on the number of shares that may be purchased in a purchase period.

On April 5, 2018, the Company's stockholders approved an amendment to the ESPP to increase the number of shares of common stock authorized for issuance under the plan by 5.0 million shares. During fiscal 2019, 2018 and 2017, the Company issued 1.2 million, 1.2 million, and 1.6 million shares, respectively, under the ESPP at average per share prices of $73.18, $62.52 and $40.85, respectively. As of October 31, 2019, 9.7 million shares of common stock were reserved for future issuance under the ESPP.

Equity Compensation Plans

2006 Employee Equity Incentive Plan. On April 25, 2006, the Company’s stockholders approved the 2006 Employee Equity Incentive Plan (2006 Employee Plan), which provides for the grant of incentive stock options, non-statutory stock options, restricted stock awards, restricted stock unit awards, stock appreciation rights and other forms of equity compensation, including performance stock awards and performance cash awards, as determined by the plan administrator. The terms and conditions of each type of award are set forth in the 2006 Employee Plan and in the award agreements governing particular awards. Options granted under this plan generally have a contractual term of seven years and generally vest over four years. On April 8, 2019, the Company's stockholders approved an amendment to, among other things, increase the number of shares of common stock reserved for future issuance under the 2006 Employee Plan by 3.2 million shares. As of October 31, 2019, an aggregate of 5.1 million stock options and 3.8 million restricted stock units were outstanding, and 12.2 million shares were available for future issuance under the 2006 Employee Plan.

2005 and 2017 Non-Employee Directors Equity Incentive Plans. On April 6, 2017, the Company’s stockholders approved the 2017 Non-Employee Directors Equity Incentive Plan (2017 Directors Plan). In connection with stockholder approval of the 2017 Directors Plan, the 2005 Non-Employee Directors Equity Incentive Plan (2005 Directors Plan) was terminated as of April 6, 2017, and no awards can be granted under the 2005 Directors Plan after that date.

Under the 2005 Directors Plan, the Company granted options to purchase 188,709 shares of common stock, which vest over a period of three to four years, with an aggregate grant date fair value of $6.7 million, to non-employee directors during fiscal 2007, fiscal 2011, fiscal 2015, and fiscal 2017. As of October 31, 2019, 65,060 stock options were outstanding under the 2005 Directors Plan.

The 2017 Directors Plan provides for equity awards to non-employee directors in the form of stock options, restricted stock units, restricted stock or a combination thereof. On April 6, 2017, the Company’s stockholders approved an aggregate of 0.45 million shares of common stock reserved under the 2017 Directors Plan.

For the fiscal year ended October 31, 2019, the Company issued an aggregate of 10,521 shares of restricted stock awards with an aggregate grant date fair value of approximately $1.2 million under the 2017 Directors Plan. Restricted stock awards generally vest on an annual basis under the 2017 Directors Plan. As of October 31, 2019, 10,521 shares of restricted stock were unvested and no stock options were outstanding, and a total of 405,092 shares of common stock were reserved for future grant under the 2017 Directors Plan.

Other Assumed Stock Plans through Acquisitions. In connection with the Company’s acquisitions in fiscal 2008, fiscal 2010, fiscal 2012, fiscal 2014, fiscal 2015, fiscal 2017, and fiscal 2018 the Company assumed certain outstanding stock awards of acquired companies. If these assumed equity awards are canceled, forfeited or expire unexercised, the underlying shares do not become available for future grant. As of October 31, 2019, $0.2 million shares of the Company’s common stock remained subject to such outstanding assumed equity awards.

Restricted Stock Units. Restricted stock units are granted under the 2006 Employee Plan as part of the Company’s incentive compensation program. In general, restricted stock units vest over three to four years and are subject to the employee's continuing service with the Company. Certain restricted stock units were granted with specific performance criteria and vest to the extent performance conditions are met. For each restricted stock unit granted under the 2006 Employee Plan, a share reserve ratio is applied for the purpose of determining the remaining number of shares reserved for future grants under the plan. As of October 31, 2019, the share reserve ratio was 1.70.

The following table contains information concerning activities related to restricted stock units:

	Restricted Stock Units	Weighted Average Grant Date Fair Value	Weighted Average Remaining Contractual Life (In Years)	Aggregate Fair Value
	(in thousands, except per share and life amounts)			
Balance at October 31, 2016	4,035	$ 46.37	1.56	
Granted	1,584	$ 70.49		
Vested(1)	(1,536)	$ 43.53		$ 110,103
Forfeited	(240)	$ 49.36		
Balance at October 31, 2017	3,843	$ 57.26	1.54	
Granted(2)	1,679	$ 89.35		
Vested(1)	(1,495)	$ 52.55		$ 136,417
Forfeited	(258)	$ 67.04		
Balance at October 31, 2018	3,769	$ 72.75	1.46	
Granted	1,844	$ 119.27		
Vested(1)	(1,508)	$ 65.97		$ 176,659
Forfeited	(248)	$ 79.49		
Balance at October 31, 2019	3,857	$ 97.21	1.56	

(1) The number of vested restricted stock units includes shares that were withheld on behalf of employees to satisfy the minimum statutory tax withholding requirements.
(2) The Company assumed unvested restricted stock units from acquisitions including Black Duck.

The following table contains additional information concerning activities related to stock options and restricted stock units under all equity plans, other than shares available for grant under the 2017 Directors Plan:

		Options(2)			
	Available for Grant(3)	Options Outstanding	Weighted-Average Exercise Price per Share	Weighted-Average Remaining Contractual Life (In Years)	Aggregate Intrinsic Value
	(in thousands, except per share and life amounts)				
Balance at October 31, 2016	11,244	6,755	$ 39.59	4.65	$ 126,850
Options granted	(1,505)	1,536	$ 68.18		
Options assumed(2)		154	$ 34.52		
Options exercised		(1,770)	$ 34.56		
Options canceled/forfeited/expired	129	(145)	$ 47.17		
Restricted stock units granted(1)	(2,694)				
Restricted stock units forfeited(1)	409				
Additional shares reserved	5,000				
Balance at October 31, 2017	12,583	6,530	$ 46.83	4.60	$ 263,555
Options granted	(1,134)	1,134	$ 89.52		
Options assumed(2)		141	$ 18.66		
Options exercised		(1,336)	$ 38.18		
Options canceled/forfeited/expired	157	(178)	$ 51.82		
Restricted stock units granted(1)	(2,541)				
Restricted stock units forfeited(1)	374				
Additional shares reserved	3,000				
Balance at October 31, 2018	12,439	6,291	$ 55.63	4.39	$ 214,432
Options granted	(799)	799	$ 113.17		
Options exercised		(1,615)	$ 44.29		
Options canceled/forfeited/expired	129	(185)	$ 58.02		
Restricted stock units granted(1)	(3,134)				
Restricted stock units forfeited(1)	373				
Additional shares reserved	3,200				
Balance at October 31, 2019	12,208	5,290	$ 65.57	4.08	$ 373,112
Exercisable at October 31, 2019		3,135	$ 53.11	3.22	$ 260,203

(1) These amounts do not reflect the actual number of restricted stock units granted or forfeited but rather the effect on the total remaining shares available for future grants after the application of the share reserve ratio. For more information about the share reserve ratio, please see *Restricted Stock Units* above.

(2) The Company assumed options outstanding under various plans through acquisitions.

(3) Excluding shares reserved for future issuance under the 2017 Directors Plan.

The aggregate intrinsic value in the preceding table represents the pretax intrinsic value based on stock options with an exercise price less than the Company’s closing stock price of $136.10 as of October 31, 2019. The pretax intrinsic value of options exercised and their average exercise prices were:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands, except per share price)		
Intrinsic value	$ 110,815	$ 71,840	$ 67,089
Average exercise price per share	$ 44.29	$ 38.18	$ 34.56

Restricted stock award activities during fiscal 2019 under the 2005 Directors Plan and 2017 Directors Plan are summarized as follows:

	Restricted Shares	Weighted-Average Grant Date Fair Value
	(in thousands, except per share)	
Unvested at October 31, 2016	43	$ 45.97
Granted	20	$ 71.34
Vested	(22)	$ 44.33
Forfeited	(3)	$ 47.65
Unvested at October 31, 2017	38	$ 59.89
Granted	15	$ 82.96
Vested	(32)	$ 62.09
Forfeited	(1)	$ 48.27
Unvested at October 31, 2018	20	$ 73.95
Granted	11	$ 116.43
Vested	(20)	$ 73.95
Forfeited	—	$ —
Unvested at October 31, 2019	11	$ 116.43

Valuation and Expense of Stock-Based Compensation. The Company estimates the fair value of stock-based awards in the form of stock options and employee stock purchase rights under employee stock purchase plans on the grant date. The value of awards expected to vest is recognized as expense over the applicable service periods. The Company uses the straight-line attribution method to recognize stock-based compensation costs over the service period of the award except for performance grants with specific performance criteria. With respect to such performance grants in each reporting period, the Company estimates the probability of achievement of applicable performance goals and recognizes related stock-based compensation expense using the graded-vesting method. The amount of stock-based compensation expense recognized in any one period can vary based on the attainment or expected attainment of the various performance goals. If such performance goals are not ultimately met, no compensation expense is recognized and any previously recognized compensation expense is reversed.

The Company uses the Black-Scholes option-pricing model to determine the fair value of stock options, stock appreciation rights and employee stock purchase plan awards. The Black-Scholes option-pricing model incorporates various subjective assumptions including expected volatility, expected term and interest rates. The expected volatility for both stock options and stock purchase rights under the ESPP is estimated by a combination of implied volatility for publicly traded options of the Company's common stock with a term of six months or longer and the historical stock price volatility over the estimated expected term of the Company's stock-based awards. The expected term of the Company's stock-based awards is based on historical experience. Restricted stock units are valued based on the closing price of the Company's common stock on the grant date.

The assumptions presented in the following table were used to estimate the fair value of stock options and employee stock purchase rights granted under the Company's stock plans or stock plans assumed from acquisitions:

	Year Ended October 31,		
	2019	2018	2017
Stock Options			
Expected life (in years)	4.1	4.1	4.1
Risk-free interest rate	1.28% - 2.73%	2.10% - 2.95%	1.73% - 2.06%
Volatility	23.16% - 24.76%	20.22% - 21.04%	18.51% - 19.67%
Weighted average estimated fair value	$22.86	$23.55	$13.56
ESPP			
Expected life (in years)	0.5 - 2.0	0.5 - 2.0	0.5 - 2.0
Risk-free interest rate	1.54% - 2.60%	1.80% - 2.73%	0.82% - 1.37%
Volatility	23.73% - 27.86%	19.99% - 21.54%	17.20% - 19.99%
Weighted average estimated fair value	$35.18	$23.34	$18.77

The compensation cost recognized in the consolidated statements of operations for the Company's stock compensation arrangements was as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Cost of products	$ 17,193	$ 14,648	$ 12,553
Cost of maintenance and service	6,385	5,467	3,918
Research and development expense	75,853	67,355	52,933
Sales and marketing expense	28,834	28,069	21,001
General and administrative expense	26,736	24,493	17,889
Stock-based compensation expense before taxes	155,001	140,032	108,294
Income tax benefit	(26,226)	(26,578)	(30,950)
Stock-based compensation expense after taxes	$ 128,775	$ 113,454	$ 77,344

As of October 31, 2019, the Company had $344.9 million of total unrecognized stock-based compensation expense relating to options and restricted stock units and awards, which is expected to be recognized over a weighted average period of 2.3 years. As of October 31, 2019, the Company had $37.2 million of total unrecognized stock-based compensation expense relating to the ESPP, which is expected to be recognized over a period of 2.0 years.

Deferred Compensation Plan. The Company maintains the Synopsys Deferred Compensation Plan (Deferred Plan), which permits eligible employees to defer up to 50% of their annual cash base compensation and up to 100% of their eligible cash variable compensation. Amounts may be withdrawn from the Deferred Plan pursuant to elections made by the employees in accordance with the terms of the plan. Since the inception of the Deferred Plan, the Company has not made any matching or discretionary contributions to the Deferred Plan. There are no Deferred Plan provisions that provide for any guarantees or minimum return on investments. Undistributed amounts under the Deferred Plan are subject to the claims of the Company’s creditors. The securities held by the Deferred Plan are classified as trading securities.

Deferred plan assets and liabilities are as follows:

	As of October 31, 2019	As of October 31, 2018
	(in thousands)	
Plan assets recorded in other long-term assets	$ 249,822	$ 212,165
Plan liabilities recorded in other long-term liabilities(1)	$ 249,822	$ 212,165

(1) Undistributed deferred compensation balances due to participants.

Income or loss from the change in fair value of the Deferred Plan assets is recorded in other income (expense), net. The increase or decrease in the fair value of the undistributed Deferred Plan obligation is recorded in total cost of revenue and operating expense. The following table summarizes the impact of the Deferred Plan:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Increase (reduction) to cost of revenue and operating expense	$ 27,759	$ 4,636	$ 29,606
Other income (expense), net	27,759	4,636	29,606
Net increase (decrease) to net income	$ —	$ —	$ —

Other Retirement Plans. The Company sponsors various retirement plans for its eligible U.S. and non-U.S. employees. Total contributions to these plans were $50.7 million, $56.5 million, and $57.4 million in fiscal 2019, 2018, and 2017, respectively. For employees in the United States and Canada, the Company matches pretax employee contributions up to a maximum of U.S. $3,000 and Canadian $4,000, respectively, per participant per year.

Note 11. Income Taxes

The domestic and foreign components of the Company's total income (loss) before provision for income taxes are as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
United States	$ 487,430	$ (18,029)	$ (2,702)
Foreign	58,076	381,572	385,800
Total income (loss) before provision for income taxes	$ 545,506	$ 363,543	$ 383,098

The components of the provision (benefit) for income taxes were as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Current:			
Federal	$ 22,821	$ (1,120)	$ 25,420
State	11,846	2,025	5,565
Foreign	61,092	140,430	92,498
	95,759	141,335	123,483
Deferred:			
Federal	(41,219)	(139,547)	95,003
State	(7,227)	(25,661)	24,440
Foreign	(34,174)	(45,102)	3,609
	(82,620)	(210,310)	123,052
Provision (benefit) for income taxes	$ 13,139	$ (68,975)	$ 246,535

The provision (benefit) for income taxes differs from the taxes computed with the statutory federal income tax rate as follows:

	Year Ended October 31,		
	2019	2018	2017
		(in thousands)	
Statutory federal tax	$ 114,557	$ 85,142	$ 134,084
State tax (benefit), net of federal effect	6,529	(32,351)	(20,071)
Tax credits	(34,485)	(35,142)	(24,365)
Tax on foreign earnings	23,467	(104,252)	(52,413)
Foreign-derived intangible income deduction	(26,615)	—	—
Tax settlements	(10,953)	(14,691)	(7,057)
Stock-based compensation	(25,356)	(19,293)	(26,205)
Changes in valuation allowance	(42,144)	78,192	47,745
Integration of acquired technologies	—	27,927	36,443
Undistributed earnings of foreign subsidiaries	6,341	(974)	(9,610)
Tax impact of repatriation	—	—	166,152
Impact of tax restructuring	—	(171,979)	—
Impact of Tax Act rate change	—	51,075	—
Transition tax	—	63,107	—
Other	1,798	4,264	1,832
Provision (benefit) for income taxes	$ 13,139	$ (68,975)	$ 246,535

The integration of acquired technologies represents the income tax effect resulting from the transfer of certain intangible assets among company-controlled entities. These intangible assets generally result from the acquisition of technology by a company-controlled entity as part of a business or asset acquisition.

The Tax Cuts and Jobs Act (Tax Act), enacted on December 22, 2017, lowered the statutory federal corporate income tax rate from 35% to 21% effective on January 1, 2018. Beginning in the Company's fiscal 2019, the annual statutory federal corporate tax rate is 21%.

The Tax Act includes certain new tax provisions listed below which apply to the Company beginning in fiscal 2019.

- A tax on global intangible low-tax income (GILTI), which is determined annually based on the Company's aggregate foreign subsidiaries' income in excess of certain qualified business asset investment return. In fiscal 2019, the Company adopted an accounting policy to account for the tax effects of GILTI in the period that it is subject to such tax.
- A base erosion and anti-abuse tax (BEAT), which functions as a minimum tax that partially disallows deductions for certain related party transactions and certain tax credits.
- A special tax deduction for foreign-derived intangible income (FDII), which, in general, allows a deduction of certain intangible income earned in the U.S. and derived from foreign sources.

During fiscal 2019, the U.S. Treasury Department issued proposed regulations that could impact the calculation of taxes related to these provisions. While the Company continues to evaluate the potential impact on its estimated annual tax rate, certain regulations have not been finalized and are subject to change.

The Tax Act also provides an exemption from federal income taxes for distributions from foreign subsidiaries made after December 31, 2017, that were not subject to the one-time transition tax. The Company has provided for foreign withholding taxes on undistributed earnings of certain of its foreign subsidiaries to the extent such earnings are no longer considered to be indefinitely reinvested in the operations of those subsidiaries of $6.3 million in fiscal 2019.

The Tax Act required the Company to pay a one-time transition tax of 15.5% on previously untaxed earnings represented by foreign cash and certain other net current assets, and 8% on the remaining earnings. In fiscal 2018, the Company recorded a tax expense of $63.1 million. Based on subsequent judicial rulings in fiscal 2019 (including *Altera Corp. et al. v. Commissioner* and the Hungarian Administrative Court ruling, see *Non-U.S. Examinations* below) the Company recorded a tax benefit of $17.9 million related to the one-time transition tax.

On July 27, 2015, the United States Tax Court (Tax Court) issued an opinion (*Altera Corp. et al. v. Commissioner*) regarding the treatment of stock-based compensation expense in intercompany cost-sharing arrangements. In view of the Tax Court opinion, the Company amended its cost-sharing arrangement effective February 1, 2016 to exclude stock-based compensation expense on a prospective basis and reflected the corresponding benefits in its income tax expense for fiscal years 2016, 2017 and 2018. On July 24, 2018, the United States Court of Appeals for the Ninth Circuit (Ninth Circuit) reversed the decision of the Tax Court, and then subsequently withdrew its decision on August 7, 2018. A rehearing of the case was held on October 16, 2018 and on June 7, 2019, the Ninth Circuit overturned the July 27, 2015 Tax Court decision. In the third quarter of 2019, as a result of the Ninth Circuit decision, the Company recorded a tax expense of $18.3 million, which is net of estimated U.S. foreign tax credits for the tax assessments related to fiscal years 2016, 2017 and 2018. The Company's intercompany cost-sharing arrangement was terminated at the end of fiscal 2018 as part of the tax restructuring.

The significant components of deferred tax assets and liabilities were as follows:

	October 31,	
	2019	2018
	(in thousands)	
Net deferred tax assets:		
Deferred tax assets:		
Accruals and reserves	$ —	$ 17,766
Deferred revenue	—	37,072
Deferred compensation	56,483	50,096
Intangible and depreciable assets	160,072	185,940
Capitalized research and development costs	48,804	4,817
Stock-based compensation	20,372	19,825
Tax loss carryovers	40,068	37,029
Foreign tax credit carryovers	20,187	64,803
Research and other tax credit carryovers	278,382	250,069
Other	—	4,480
Gross deferred tax assets	624,368	671,897
Valuation allowance	(157,343)	(201,258)
Total deferred tax assets	467,025	470,639
Deferred tax liabilities:		
Intangible assets	58,697	72,682
Accruals and reserves	4,450	—
Deferred revenue	6,611	—
Undistributed earnings of foreign subsidiaries	6,864	523
Other	1,762	—
Total deferred tax liabilities	78,384	73,205
Net deferred tax assets	$ 388,641	$ 397,434

It is more likely than not that the results of future operations will be able to generate sufficient taxable income to realize the net deferred tax assets. The valuation allowance provided against the Company's deferred tax assets as of October 31, 2019 is mainly attributable to U.S. and international foreign tax credits and the California research credits. The valuation allowance decreased by a net of $43.9 million in fiscal 2019 primarily related to the realizability of $28.1 million U.S. foreign tax credits related to the transfer of intangibles associated with the tax restructuring in fiscal 2018. The remainder of the net decrease in valuation allowance relates to current year California research credit usage, and available foreign tax credits.

The Company has the following tax loss and credit carryforwards available to offset future income tax liabilities:

Carryforward	Amount	Expiration Date
	(in thousands)	
Federal net operating loss carryforward	$ 82,002	2020-2037
Federal research credit carryforward	144,672	2020-2039
Federal foreign tax credit carryforward	7,014	2020-2029
International foreign tax credit carryforward	15,522	Indefinite
International net operating loss carryforward	85,785	2021-Indefinite
California research credit carryforward	187,685	Indefinite
Other state research credit carryforward	13,429	2023-2034
State net operating loss carryforward	71,709	2027-2037

The federal and state net operating loss carryforward is from acquired companies and the annual use of such loss is subject to significant limitations under Internal Revenue Code Section 382 and certain provisions of the Tax Act. Foreign tax credits may only be used to offset tax attributable to foreign source income.

The gross unrecognized tax benefits decreased by approximately $14.8 million during fiscal 2019 resulting in gross unrecognized tax benefits of $116.2 million as of October 31, 2019. A reconciliation of the beginning and ending balance of gross unrecognized tax benefits is summarized as follows:

	As of October 31, 2019	As of October 31, 2018
	(in thousands)	
Beginning balance	$ 131,019	$ 91,637
Increases in unrecognized tax benefits related to prior year tax positions	41,346	2,572
Decreases in unrecognized tax benefits related to prior year tax positions	(71,092)	(27,615)
Increases in unrecognized tax benefits related to current year tax positions	16,927	67,961
Decreases in unrecognized tax benefits related to settlements with taxing authorities	(1,624)	(175)
Reductions in unrecognized tax benefits due to lapse of applicable statute of limitations	(964)	(8,828)
Increases in unrecognized tax benefits acquired	—	7,886
Changes in unrecognized tax benefits due to foreign currency translation	600	(2,419)
Ending balance	$ 116,212	$ 131,019

As of October 31, 2019 and 2018, approximately $116.2 million and $120.9 million, respectively, of the unrecognized tax benefits would affect the Company's effective tax rate if recognized upon resolution of the uncertain tax positions.

Interest and penalties related to estimated obligations for tax positions taken in the Company’s tax returns are recognized as a component of income tax expense (benefit) in the consolidated statements of operations and totaled approximately $0.3 million, $9.4 million and $0.2 million for fiscal years 2019, 2018 and 2017, respectively. As of October 31, 2019 and 2018, the combined amount of accrued interest and penalties related to tax positions taken on the Company’s tax returns was approximately $12.8 million and $12.6 million, respectively.

The timing of the resolution of income tax examinations, and the amounts and timing of various tax payments that are part of the settlement process, are highly uncertain. Variations in such amounts and/or timing could cause large fluctuations in the balance sheet classification of current and non-current assets and liabilities. The Company believes that in the coming 12 months, it is reasonably possible that either certain audits and ongoing tax litigation will conclude or the statute of limitations on certain state and foreign income and withholding taxes will expire, or both. Given the uncertainty as to ultimate settlement terms, the timing of payment and the impact of such settlements on other uncertain tax positions, the range of the estimated potential decrease in underlying unrecognized tax benefits is between $0.0 and $42.2 million.

The Company and/or its subsidiaries remain subject to tax examination in the following jurisdictions:

Jurisdiction	Year(s) Subject to Examination
United States	Fiscal 2019
California	Fiscal years after 2014
Hungary and Ireland	Fiscal years after 2013
Japan and Taiwan	Fiscal years after 2014
Korea	Fiscal years after 2016

In addition, the Company has made acquisitions with operations in several of its significant jurisdictions which may have years subject to examination different from the years indicated in the above table.

Intra-Entity Transfers of Assets

In October 2016, the FASB issued ASU 2016-16, "Income Taxes (Topic 740), Intra-Entity Transfers of Assets Other Than Inventory." This ASU requires the immediate recognition of current and deferred income tax effects of intra-entity transfers of assets other than inventory. This ASU was adopted on the first day of fiscal 2019. As a result of the adoption, the Company recorded a decrease of approximately $130.5 million in retained earnings as of the beginning of the period of adoption, with a corresponding decrease in prepaid taxes related to the unamortized tax expense attributed to intra-entity transfers of assets other than inventory previously deferred. The Company will recognize the income tax consequences of new intra-entity transfers of assets other than inventory in the consolidated statements of operations in the period when the transaction takes place.

IRS Examinations

In fiscal 2019, the Company reached final settlement with the Examination Division of the IRS for fiscal 2018 and recognized approximately $5.4 million in unrecognized tax benefits and realized $28.1 million of foreign tax credits.

In fiscal 2018, the Company reached final settlement with the Examination Division of the IRS for fiscal 2017 and recognized approximately $21.8 million in unrecognized tax benefits, primarily due to the allowance of certain foreign tax credits, and research tax credits from acquired companies.

In fiscal 2017, the Company reached final settlement with the Examination Division of the IRS for fiscal 2016 and recognized approximately $4.6 million in unrecognized tax benefits.

State Examinations

The Company is undergoing an audit by the California Franchise Tax Board for fiscal years 2015 through 2017. No material assessments have been proposed in these examinations.

In fiscal 2017, the Company reached final settlement with the California Franchise Tax Board for fiscal 2014, 2013, and 2012. As a result of the settlement, the Company recognized tax expense of $0.4 million, reduced its deferred tax assets by $1.1 million, recognized $14.6 million in unrecognized tax benefits, and increased its valuation allowance by $13.2 million.

Non-U.S. Examinations

Hungarian Tax Authority

In July 2017, the Hungarian Tax Authority (the HTA) issued a final assessment against the Company's Hungarian subsidiary (Synopsys Hungary) for fiscal years 2011 through 2013. The HTA has applied withholding taxes on certain payments made to affiliates, resulting in an aggregate tax assessment of approximately $25.0 million and interest and penalties of $11.0 million (at current exchange rates). On August 2, 2017, Synopsys Hungary filed a claim contesting the final assessment with the Hungarian Administrative Court. In the first quarter of fiscal 2018, Synopsys Hungary paid the assessments, penalties and interest as required by law and recorded these amounts as prepaid taxes on its balance sheet, while continuing its challenge to the assessment through the Hungarian Administrative Court. On April 30, 2019, the Hungarian Administrative Court (the Court) ruled against Synopsys Hungary. The Court's opinion was received on May 16, 2019 and the Company filed an appeal with the Hungarian Supreme Court on July 5, 2019. In the second quarter of 2019, as a result of the Court's decision, the Company recorded a tax expense due to an unrecognized tax benefit of $17.4 million, which is net of estimated U.S. foreign tax credits for the tax assessments.

The Company is undergoing an audit by the HTA for fiscal years 2014 through 2018. No material assessments have been proposed in these examinations.

Korea National Tax Service

In fiscal 2017, the Company reached final settlement with the Korea National Tax Service for fiscal years 2012 to 2016. As a result of the settlement, the Company recognized income tax expense of $7.9 million.

National Taxation Bureau of Taipei

In fiscal 2019, the Company reached final settlement with the National Taxation Bureau of Taipei for fiscal year 2017 and recognized $5.5 million in previously unrecognized tax benefits.

In fiscal 2017, the Company reached final settlement with the National Taxation Bureau of Taipei on certain tax positions for fiscal year 2014 resulting in an income tax benefit of $10.9 million.

Note 12. Other Income (Expense), Net

The following table presents the components of other income (expense), net:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Interest income	$ 6,859	$ 5,323	$ 7,241
Interest expense	(11,659)	(15,607)	(7,303)
Gain (loss) on assets related to deferred compensation plan	27,759	4,636	29,606
Foreign currency exchange gain (loss)	3,588	3,557	3,354
Other, net	(1,272)	5,409	2,637
Total	$ 25,275	$ 3,318	$ 35,535

Note 13. Segment Disclosure

Segment reporting is based upon the “management approach,” i.e., how management organizes the Company’s operating segments for which separate financial information is (1) available and (2) evaluated regularly by the CODMs in deciding how to allocate resources and in assessing performance. Synopsys’ CODMs are its two co-Chief Executive Officers.

In prior periods, the Company operated in a single segment. Effective in fiscal 2019, the Company realigned its business to evaluate the results of its Software Integrity business separately from the Company’s traditional EDA and semiconductor IP business. The CODMs now regularly review disaggregated information for the following two reportable segments: (1) Semiconductor & System Design, which includes EDA tools, IP products, system integration solutions and other revenue categories, and (2) Software Integrity, which includes a comprehensive solution for building integrity—security, quality and compliance testing—into the customers’ software development lifecycle and supply chain. The Company’s historical results have been recast to retrospectively reflect the change from one to two reportable segments.

As a result of the change in reporting structure, financial information provided to and used by the CODMs to assist in making operational decisions, allocating resources, and assessing performance reflects consolidated financial information as well as revenue, adjusted operating income, and adjusted operating margin information for the Semiconductor & System Design and Software Integrity segments, accompanied by disaggregated information relating to revenues by geographic region.

Information by reportable segment was as follows:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Total Segments:			
Revenues	$ 3,360,694	$ 3,121,058	$ 2,724,880
Adjusted operating income	838,821	690,681	647,255
Adjusted operating margin	25%	22 %	24 %
Semiconductor & System Design:			
Revenues	$ 3,026,097	$ 2,840,589	$ 2,551,130
Adjusted operating income	806,618	701,283	667,164
Adjusted operating margin	27%	25 %	26 %
Software Integrity:			
Revenues	$ 334,597	$ 280,469	$ 173,750
Adjusted operating income	32,203	(10,602)	(19,909)
Adjusted operating margin	10%	(4)%	(11)%

Certain operating expenses are not allocated to the segments and are managed at a consolidated level. The unallocated expenses managed at a consolidated level, including amortization of intangible assets, stock compensation and other operating expenses, are presented in the table below to provide a reconciliation of the total adjusted operating income from segments to the Company's consolidated operating income:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Total segment adjusted operating income	$ 838,821	$ 690,681	$ 647,255
Reconciling items:			
Amortization of intangible expense	(100,914)	(125,664)	(107,723)
Stock-based compensation expense	(155,001)	(140,032)	(108,294)
Other	(62,675)	(64,760)	(83,675)
Total operating income	$ 520,231	$ 360,225	$ 347,563

The CODMs do not use total assets by segment to evaluate segment performance or allocate resources. As a result, total assets by segment are not required to be disclosed.

In allocating revenue to particular geographic areas, the CODMs consider where individual “seats” or licenses to the Company’s products are located. Revenue is defined as revenues from external customers. Revenues and property and equipment, net, related to operations in the United States and other geographic areas were:

	Year Ended October 31,		
	2019	2018	2017
	(in thousands)		
Revenue:			
United States	$ 1,676,178	$ 1,508,224	$ 1,357,364
Europe	349,033	369,125	308,419
Korea	353,358	307,974	291,103
Japan	272,677	283,337	247,631
Asia Pacific and Other	709,448	652,398	520,363
Consolidated	$ 3,360,694	$ 3,121,058	$ 2,724,880

	As of October 31,	
	2019	2018
	(in thousands)	
Property and Equipment, net:		
United States	$ 293,725	$ 210,914
Other countries	135,807	98,396
Total	$ 429,532	$ 309,310

Geographic revenue data for multi-regional, multi-product transactions reflect internal allocations and are therefore subject to certain assumptions and to the Company's methodology.

One customer, including its subsidiaries, accounted for 12.8%, 15.4%, and 17.9% of the Company's consolidated revenue in fiscal 2019, 2018, and 2017, respectively.

Note 14. Effect of New Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, "Leases (Topic 842)," which supersedes the lease requirements in "Leases (Topic 840)." This ASU was subsequently amended by ASU 2017-13, ASU 2018-01, ASU 2018-10, ASU 2018-11 (collectively, Topic 842). Topic 842 requires a lessee to recognize a right-of-use asset and a lease payment liability for most operating leases in the consolidated balance sheets. Topic 842 also makes minor changes to lessor accounting and aligns key aspects of the lessor accounting model with the new revenue recognition guidance. Topic 842 is effective for the Company on November 3, 2019.

The Company will adopt this new lease standard using the modified retrospective transition method without restatement of comparative periods, which is allowed under Topic 842. The Company will also elect the package of practical expedients to combine lease and non-lease components in the existing leases upon adoption. The Company's lease portfolio primary consisted of facility leases and the impact of adoption is expected to be material to the consolidated balance sheets.

In June 2016, the FASB issued ASU 2016-13, Financial Instruments—Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments (ASU 2016-13) and subsequently issued amendments to the initial guidance: ASU 2018-19, ASU 2019-04 and ASU 2019-05 (collectively, Topic 326). Topic 326 requires measurement and recognition of expected credit losses for financial assets held. Topic 326 is effective for fiscal 2021, and earlier adoption is permitted beginning in the first quarter of fiscal 2020. The company is currently evaluating the impact of the pending adoption of Topic 326 on the consolidated financial statements.

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Supplementary Data - Selected Unaudited Quarterly Financial Data

The table below includes certain unaudited financial information for the last eight fiscal quarters. See *Note 2. Summary of Significant Accounting Policies* for information on the Company's fiscal year end.

	Quarter Ended			
	January 31,	April 30,	July 31,	October 31,
	(in thousands, except per share amounts)			
2019				
Revenue	$ 820,401	$ 836,242	$ 852,970	$ 851,081
Gross margin	627,509	645,563	666,338	668,338
Income before provision for income taxes	147,055	133,917	132,911	131,623
Net income	153,514	118,210	99,929	160,714
Net income per share				
Basic	$ 1.03	$ 0.79	$ 0.67	$ 1.07
Diluted(1)	1.01	0.77	0.65	1.04
2018				
Revenue	$ 769,426	$ 776,836	$ 779,714	$ 795,082
Gross margin	588,270	598,057	594,333	604,500
Income before provision for income taxes	120,103	119,299	71,893	52,248
Net (loss) income	(3,691)	102,472	79,409	254,328
Net (loss) income per share				
Basic	$ (0.02)	$ 0.69	$ 0.53	$ 1.71
Diluted(1)	(0.02)	0.67	0.52	1.66

(1) Net income (loss) per share is computed independently. Therefore, the sum of the quarterly net income (loss) per share may not equal to the total computed for the year or any cumulative interim period.

Item 9. *Changes in and Disagreements with Accountants on Accounting and Financial Disclosure*

Not applicable.

Item 9A. *Controls and Procedures*

(a) *Evaluation of Disclosure Controls and Procedures.* As of October 31, 2019, Synopsys carried out an evaluation under the supervision and with the participation of Synopsys' management, including the Co-Chief Executive Officers and Chief Financial Officer, of the effectiveness of the design and operation of Synopsys' disclosure controls and procedures (as such term is defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act). There are inherent limitations to the effectiveness of any system of disclosure controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable, not absolute, assurance of achieving their control objectives. Our Co-Chief Executive Officers and Chief Financial Officer have concluded that, as of October 31, 2019, Synopsys' disclosure controls and procedures were effective to provide reasonable assurance that information required to be disclosed in the reports Synopsys files and submits under the Exchange Act is recorded, processed, summarized and reported as and when required, and that such information is accumulated and communicated to Synopsys' management, including the Co-Chief Executive Officers and Chief Financial Officer, to allow timely decisions regarding its required disclosure.

(b) *Management's Report on Internal Control Over Financial Reporting.* Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) for Synopsys.

Under the supervision and with the participation of our management, including our Co-Chief Executive Officers and Chief Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting as of October 31, 2019. In assessing the effectiveness of our internal control over financial reporting, our management used the framework established in *Internal Control Integrated Framework (2013)* issued by The Committee of Sponsoring Organizations of the Treadway Commission (COSO).

Our management has concluded that, as of October 31, 2019, our internal control over financial reporting was effective based on these criteria. Our independent registered public accounting firm, KPMG LLP, has issued an auditors' report on the effectiveness of our internal control over financial reporting, which is included herein.

(c) *Changes in Internal Control Over Financial Reporting.* On November 4, 2018, Synopsys implemented new and modified existing internal controls for the adoption of the new revenue recognition accounting standard, ASC 606. There were no additional changes in Synopsys' internal control over financial reporting during the fiscal quarter ended October 31, 2019 that have materially affected, or are reasonably likely to materially affect, Synopsys' internal control over financial reporting.

Item 9B. *Other Information*

None.

PART III

Item 10. *Directors, Executive Officers and Corporate Governance*

For information with respect to our executive officers, see *Executive Officers of the Registrant* in Part I, Item 1 of this Annual Report.

All other information required by this Item is incorporated herein by reference from our definitive Proxy Statement for the 2020 Annual Meeting of Stockholders (the Proxy Statement) scheduled to be held on April 9, 2020, as provided under the headings “Proposal 1: Election of Directors,” “Audit Committee Report,” and “Corporate Governance.”

Item 11. *Executive Compensation*

The information required by this Item is incorporated herein by reference from the Proxy Statement, as provided under the headings “Compensation Discussion and Analysis” (and all subheadings thereunder), "Executive Compensation Tables" (and all subheadings thereunder), "Director Compensation," “Compensation Committee Interlocks and Insider Participation,” and “Compensation Committee Report.”

Item 12. *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters*

The information required by this Item is incorporated herein by reference from the Proxy Statement, as provided under the headings “Equity Compensation Plan Information” and “Security Ownership of Certain Beneficial Owners and Management.”

Item 13. *Certain Relationships and Related Transactions and Director Independence*

The information required by this Item is incorporated herein by reference from the Proxy Statement, as provided under the headings “Certain Relationships and Related Transactions” and “Corporate Governance” (under the subheading “Director Independence”).

Item 14. *Principal Accountant Fees and Services*

The information required by this Item is incorporated herein by reference from the Proxy Statement, as provided under the subheadings "Fees and Services of Independent Registered Public Accounting Firm" and "Audit Committee Pre-Approval Policies and Procedures" under the proposal titled “Ratification of Selection of Independent Registered Public Accounting Firm.”

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PART IV

Item 15. *Exhibits and Financial Statement Schedules*

(a) The following documents are filed as part of this Form 10-K:

(1) Financial Statements

The following documents are included as Part II, Item 8 of this Form 10-K:

(2) Financial Statement Schedules

Schedules not listed above have been omitted because the information required to be set forth therein is not applicable or is shown in the financial statements or notes herein.

(3) Exhibits

See Item 15(b) below.

(b) Exhibits

EXHIBIT INDEX

Exhibit Number	Exhibit Description	Incorporated By Reference				Filed or Furnished Herewith
		Form	File No.	Exhibit	Filing Date	
3.1	Amended and Restated Certificate of Incorporation	10-Q	000-19807	3.1	9/15/2003	
3.2	Amended and Restated Bylaws	10-K	000-19807	3.2	12/17/2018	
4.1	Specimen Common Stock Certificate	S-1	33-45138	4.3	2/24/1992 (effective date)	
4.2	Description of Synopsys' Stock					X

Exhibit Number	Exhibit Description	Incorporated By Reference				Filed or Furnished Herewith
		Form	File No.	Exhibit	Filing Date	
10.1	Amended and Restated Credit Agreement, dated November 28, 2016, among Synopsys as Borrower, the several Lenders from time to time parties thereto, Bank of America, N.A., the Bank of Tokyo-Mitsubishi UFJ, Ltd. and Wells Fargo Bank, N.A. as Co-Syndication Agents, HSBC Bank USA, N.A. and U.S. Bank N.A. as Co-Documentation Agents, JPMorgan Chase Bank, N.A., as Administrative Agent, and JPMorgan Chase Bank, N.A., Merrill Lynch, Pierce, Fenner & Smith Incorporated, the Bank of Tokyo-Mitsubishi UFJ, Ltd. and Wells Fargo Securities, LLC, as Co-Lead Arrangers and Co-Bookrunners	8-K	000-19807	10.1	11/30/2016	
10.2	Lease Agreement dated October 14, 2011 between Synopsys, Inc. and 690 E. Middlefield Road Fee, LLC, (“The October 14, 2011 Lease”)	10-K	000-19807	10.19	12/16/2011	
10.2(i)†	Notification of Change of Ownership of Leased Premises under The October 14, 2011 Lease—Effective May 9, 2012	10-K	000-19807	10.10(i)	12/20/2012	
10.2(ii)	First Amendment to The October 14, 2011 Lease	10-Q	000-19807	10.10(ii)	3/4/2013	
10.2(iii)	Second Amendment to The October 14, 2011 Lease	10-Q	000-19807	10.10(iii)	5/22/2015	
10.3	Lease Agreement, dated January 2, 1996 between Synopsys, Inc. and Tarigo-Paul, a California Limited Partnership, (“The January 2, 1996 Lease”)	10-Q	000-19807	10.28	5/14/1996	
10.3(i)	First Amendment to The January 2, 1996 Lease	8-K	000-19807	10.42	9/12/2006	
10.3(ii)	Second Amendment to The January 2, 1996 Lease	8-K	000-19807	10.41	9/12/2006	
10.3(iii)	Third Amendment to The January 2, 1996 Lease	10-K	000-19807	10.8(iii)	12/20/2012	
10.3(iv)	Fourth Amendment to The January 2, 1996 Lease	10-K	000-19807	10.8(iv)	12/20/2012	
10.3(v)†	Notification of Change of Ownership of Leased Premises under The January 2, 1996 Lease—Effective September 25, 2012	10-K	000-19807	10.8(v)	12/20/2012	
10.4*	2006 Employee Equity Incentive Plan, as amended	8-K	000-19807	10.4	4/9/2019	

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Exhibit Number	Exhibit Description	Incorporated By Reference Form	File No.	Exhibit	Filing Date	Filed or Furnished Herewith
10.5*	Form of Restricted Stock Unit Grant Notice and Award Agreement under 2006 Employee Equity Incentive Plan	8-K	000-19807	10.5	4/6/2018	
10.6*	Form of Notice of Grant of Stock Options and Option Agreement under 2006 Employee Equity Incentive Plan	8-K	000-19807	10.6	4/6/2018	
10.7*	Employee Stock Purchase Plan, as amended	8-K	000-19807	10.7	4/6/2018	
10.8*	2017 Non-Employee Directors Equity Incentive Plan	8-K	000-19807	10.8	4/10/2017	
10.9*	Form of Restricted Stock Grant Notice and Award Agreement under 2017 Non-Employee Directors Equity Incentive Plan	10-K	000-19807	10.9	12/14/2017	
10.10*	Form of Stock Options Grant Notice and Option Agreement under 2017 Non-Employee Directors Equity Incentive Plan	10-K	000-19807	10.10	12/14/2017	
10.11*	Deferred Compensation Plan as restated effective August 1, 2002	10-Q	000-19807	10.5	6/10/2004	
10.12*	Synopsys Amended and Restated Deferred Compensation Plan II	10-Q	000-19807	10.23	3/9/2009	
10.13	Form of Indemnification Agreement for directors and executive officers	8-K	000-19807	99.2	7/14/2011	
10.14*	Director's and Officer's Insurance and Company Reimbursement Policy	S-1	33-45138	10.2	2/24/1992 (effective date)	
10.15*	Amended and Restated Employment Agreement, dated December 15, 2016 between Synopsys, Inc. and Dr. Aart de Geus	8-K	000-19807	10.16	12/21/2016	
10.16*	Amended and Restated Employment Agreement, dated December 15, 2016 between Synopsys, Inc. and Dr. Chi-Foon Chan	8-K	000-19807	10.17	12/21/2016	
10.17*	Executive Incentive Plan, as amended	8-K	000-19807	10.18	12/21/2016	
10.18*	Amended and Restated Executive Change of Control Severance Benefit Plan	8-K	000-19807	10.19	12/21/2016	
10.19*	Compensation Recovery Policy	10-K	000-19807	10.46	12/22/2008	
21.1	Subsidiaries of Synopsys, Inc.					X

Exhibit Number	Exhibit Description	Incorporated By Reference Form	File No.	Exhibit	Filing Date	Filed or Furnished Herewith
23.1	Consent of KPMG LLP, Independent Registered Public Accounting Firm					X
24.1	Power of Attorney (see signature page to this Annual Report on Form 10-K)					X
31.1	Certification of Co-Chief Executive Officer pursuant to Rule 13a-14(a) or Rule 15d-14(a) of the Exchange Act					X
31.2	Certification of Co-Chief Executive Officer pursuant to Rule 13a-14(a) or Rule 15d-14(a) of the Exchange Act					X
31.3	Certification of Chief Financial Officer pursuant to Rule 13a-14(a) or Rule 15d-14(a) of the Exchange Act					X
32.1	Certification of Co-Chief Executive Officers and Chief Financial Officer furnished pursuant to Rule 13a-14(b) or Rule 15d-14(b) of the Exchange Act and Section 1350 of Chapter 63 of Title 18 of the United States Code					X
101.INS	Inline XBRL Instance Document					X
101.SCH	Inline XBRL Taxonomy Extension Schema Document					X
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document					X
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document					X
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document					X
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document					X
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)					

* Indicates a management contract, compensatory plan or arrangement.
† We have requested confidential treatment for certain portions of this document pursuant to an application for confidential treatment sent to the SEC. We omitted such portions from this filing and filed them separately with the SEC.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

		SYNOPSYS, INC.
Date: December 20, 2019	By:	/s/ Trac Pham
		Trac Pham **Chief Financial Officer** **(Principal Financial Officer)**

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Aart J. de Geus, Chi-Foon Chan and Trac Pham, and each of them, as his true and lawful attorneys-in-fact and agents, with full power of substitution and reconstitution, for him and in his name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents, or any of them, or their or his substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated:

Name	Title	Date
/S/ AART J. DE GEUS Aart J. de Geus	Co-Chief Executive Officer (Co-Principal Executive Officer) and Chairman of the Board of Directors	December 20, 2019
/S/ CHI-FOON CHAN Chi-Foon Chan	Co-Chief Executive Officer (Co-Principal Executive Officer), President and Director	December 20, 2019
/S/ TRAC PHAM Trac Pham	Chief Financial Officer (Principal Financial Officer)	December 20, 2019
/S/ SUDHINDRA KANKANWADI Sudhindra Kankanwadi	Vice President, Corporate Controller (Principal Accounting Officer)	December 20, 2019
/S/ JANICE D. CHAFFIN Janice D. Chaffin	Director	December 20, 2019
/S/ BRUCE R. CHIZEN Bruce R. Chizen	Director	December 20, 2019
/S/ MERCEDES JOHNSON Mercedes Johnson	Director	December 20, 2019
/S/ CHRYSOSTOMOS L. NIKIAS Chrysostomos L. Nikias	Director	December 20, 2019
/S/ JOHN G. SCHWARZ John G. Schwarz	Director	December 20, 2019
/S/ ROY VALLEE Roy Vallee	Director	December 20, 2019
/S/ STEVEN C. WALSKE Steven C. Walske	Director	December 20, 2019