Overview

Advanced electronics continue to permeate all aspects of automotive design as consumer demand for safety, performance, fuel efficiency, reliability and infotainment continues to grow. Automotive companies face increasing business pressure not only for more advanced functions and performance, but also to control the rising cost of warranty issues, global supply-chain management, and shorter market windows. The electronic content in vehicle design incorporates semiconductor, FPGA, PCB, mechatronic, IP and embedded software design to create cost-effective and reliable systems. Integrating all aspects of this electronic content requires careful attention to component design and system interactions to minimize warranty costs, meet performance specifications, and enhance reliability under constantly changing environmental and operational conditions.

Key Benefits

Electronic components, embedded software, and mechatronic/power systems greatly enhance vehicle performance and flexibility, but can be a source of reliability and quality issues as new functions are added at an accelerated pace. This dramatic increase in electronic complexity makes design tools indispensable in the development of modern automotive systems. Synopsys has the tools, IP and methodologies necessary for today’s complex automotive designs, from systems to silicon.

- Design and verify electronic/mechatronic automotive systems for both under-the-hood and infotainment/driver assistance applications
- Reduce design cycle time at the IC, FPGA, mechatronic system, and embedded software level
  - Leverage virtual prototypes to integrate and test embedded software controls, using a full system representation before physical prototypes are available
  - Verify component and system interaction across multiple physical domains (electrical, mechanical, hydraulic, magnetic, thermal) using Robust Design/DFSS methodologies
- Develop high-performance, technology-independent FPGAs for driver assistance, infotainment and front-end safety applications
- Design and validate mixed-signal, full-custom and standard cell ICs for any automotive application
- Leverage silicon-proven design IP such as USB, PCI Express®, DDR, HDMI, Ethernet AVB, ARC® processors and IP subsystems to reduce design schedule risk and faster time-to-market for infotainment systems
- Drive higher overall product accuracy and reduce development time for the entire design chain with model-based exchange
Early Software Development and Test with Virtual ECUs

Powertrain and hybrid controllers, chassis and safety systems, body electronics, advanced driver assistance systems, infotainment devices and instrument clusters are part of the increasing electronic content in automobiles and translate into increasing software development, debug and test efforts. The challenges of creating robust code are felt throughout the automotive electronic supply chain, from semiconductor companies to Tier 1 and OEM suppliers. Improved software development and test productivity in automotive not only results in faster time-to-market and contained development costs, but also in safer more reliable products.

Synopsys’ Virtualizer™ Development Kits (VDKs) help automotive designers address their software development challenges. VDKs are software development kits containing virtual prototypes of automotive-specific microcontroller units (MCUs) and system-on-chips (SoCs), as well as debug and analysis tools and sample software that enable engineers to start software development and integration and test activities months before the hardware design is available.

Mechatronic and Power Systems – Robust Design Methodologies

Reliable vehicle operation depends on successful integration and verification of many multi-domain component interactions under varying operational and environmental conditions. Given the extraordinary complex nature of hardware and software controls in powertrain and H/EV design, engineers need Robust Design tools and methodologies to create systems that improve performance, reduce cost and maximize reliability.

The Synopsys Saber® Platform incorporates Robust Design/DFSS methodologies to enable design teams to model, analyze, and optimize system-level interactions for multiple automotive technologies including, electrical, mechanical, hydraulic and magnetic systems. Through the use of Saber, automotive designers can perform a greater number of tests and design variations compared to a hardware prototype, reducing design cycle time and maximizing safety and reliability.

Wire Harness Design and Simulation

The wire harness forms the backbone of the entire electrical system of automotive vehicles. The correct and reliable implementation of the wire harness represents one of the most expensive and technically challenging aspects of vehicle systems design.

Saber Harness provides proven design and verification capabilities in conjunction with the Saber Platform to create correct-by-design wire harnesses. Designers can create functional diagrams and electrical schematics, export component and wire data, import geometry information from MCAD tools, simulate electrical functions, create bundles with connector positions and generate data for manufacturing – all within a single design tool.

FPGA Design for Flexibility and Fast Algorithm Implementation

Over the past decade, the automotive industry has made great strides in advanced driver assistance (DA) systems that provide drivers with invaluable information about the road around them, enriching the overall driving experience. FPGAs are well-suited to meet these requirements by providing the computational power necessary for signal processing algorithms, scalability to meet future needs and provide an attractive range of cost targets for high volume applications.
Synopsys provides a vendor neutral environment for FPGA implementation, providing automotive companies with the flexibility to target their designs to the best FPGA architecture based on cost and performance requirements. Synopsys' full-range of FPGA design and verification tools include Synphony Model™ Compiler to synthesize DSP algorithms into hardware, Synplify Pro® for logic synthesis, and the HAPS® FPGA-based prototyping systems to validate and test automotive systems for front-end safety, navigation and driver assistance.

**IC Design and Verification**

Automotive semiconductors have revolutionized vehicle design, making it possible to precisely control and manage an array of functions previously serviced by several systems. Integrated circuits common in automotive design include analog/mixed-signal, DSPs, and ECUs networked together to provide critical functions such as safety, vehicle dynamics, communications and engine and powertrain controls.

Synopsys offers a complete suite of digital and analog/mixed-signal IC tools with the Galaxy™ Design Platform and Galaxy Custom Designer®, including place and route tools tuned for reliability as well as specialized device types. Verification tools within the Discovery™ Verification Platform are used by leading automotive companies to analyze and verify digital, analog and mixed-signal designs to ensure high-quality, robust designs that meet power and testability requirements.

**DesignWare IP for Faster Time-to-Market**

The future of the automotive industry is moving towards more connected cars with the ability to access the Internet, offer infotainment and car-to-car communications, provide engine management, and much more. By leveraging high-quality, silicon-proven third-party semiconductor IP, designers can incorporate the necessary functionality into their automotive designs with extremely low risk and faster time-to-market.

Synopsys offers a broad range of DesignWare® IP solutions for end-to-end automotive applications. DesignWare PCI Express, SATA and Ethernet Quality-of-Service IP brings faster time-to-market for automotive infotainment systems and automotive controls, and USB 3.0 simplifies the connection of consumer electronic devices within the cabin. Automotive telematics systems incorporate high-performance, low-power DesignWare MIPI IP, and advanced applications like collision avoidance and engine management implement the high-performance DesignWare DDR IP.

In addition, the DesignWare Floating Point components support “under-the-hood” functions by enabling real-time floating point calculations for control and status, while DesignWare Analog IP offers high-speed data converters for wireless interfaces and mobile TV/radio applications, sensor data converters for sensor applications, and audio codecs for high-quality audio applications.

The DesignWare Sensor IP Subsystem integrates hardware, software and DSP functions that enable designers to incorporate sensor functionality into automotive applications.

Most of the advanced capabilities that are available in automobiles today are the result of systems that are controlled by embedded 32-bit microprocessors. Microprocessors are extensively used in a range of applications, from powertrain and safety systems to infotainment and communication systems, to increase functionality while making systems more flexible and easier to use.

Synopsys offers a full range of 32-bit microprocessor IP cores with solutions for the smallest, lowest power sensors to more sophisticated, high-performance drive train, infotainment and communications systems. For safety systems that need to be certified against the ISO 26262 standard, Synopsys offers the ARC EM Safety Enhancement Package (SEP) Core. This product solution combines processor IP with safety features, ASIL readiness certified compiler tools and safety documentation to help ease the ISO 26262 certification process.

Offering clock speeds up to 1 GHz and power consumption as low as 4 µW/MHz, ARC processor cores are reliable, configurable and user customizable, enabling them to be tailored to the specific application requirements, which maximizes performance while minimizing power consumption and cost.

**Synopsys Solutions for Automotive Design**

Synopsys provides automotive OEMs and their suppliers with comprehensive tools and methodologies for the design, verification and test of automotive electronics, power systems and embedded software. Find out more about Synopsys’ proven automotive design tools and services by visiting us on the web at http://www.synopsys.com/automotive or calling +1-650.584.5000.

For more information about Synopsys products, support services or training, visit us on the web at: www.synopsys.com, contact your local sales representative or call 650.584.5000.