Siemens PLM Software

Adding intelligence to electrical systems

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The nervous systems of smart, connected products

In the Internet of Things (IoT) era, the electronics content going into traditionally mechanical products is increasing dramatically. These electronics allow smart, connected products to sense, process, respond and communicate. All are incredibly crucial.

All those electronics cannot do their jobs alone. They must all be interconnected to function as a whole. Signals from sensors are carried via wires to embedded control boxes. Signals are sent out to actuated components. Data meant for IoT platforms must travel over a wire to network antennas. The wires, cables, and bundles are the nervous systems of modern products. Electrical systems are just as critical as the electronics they connect.

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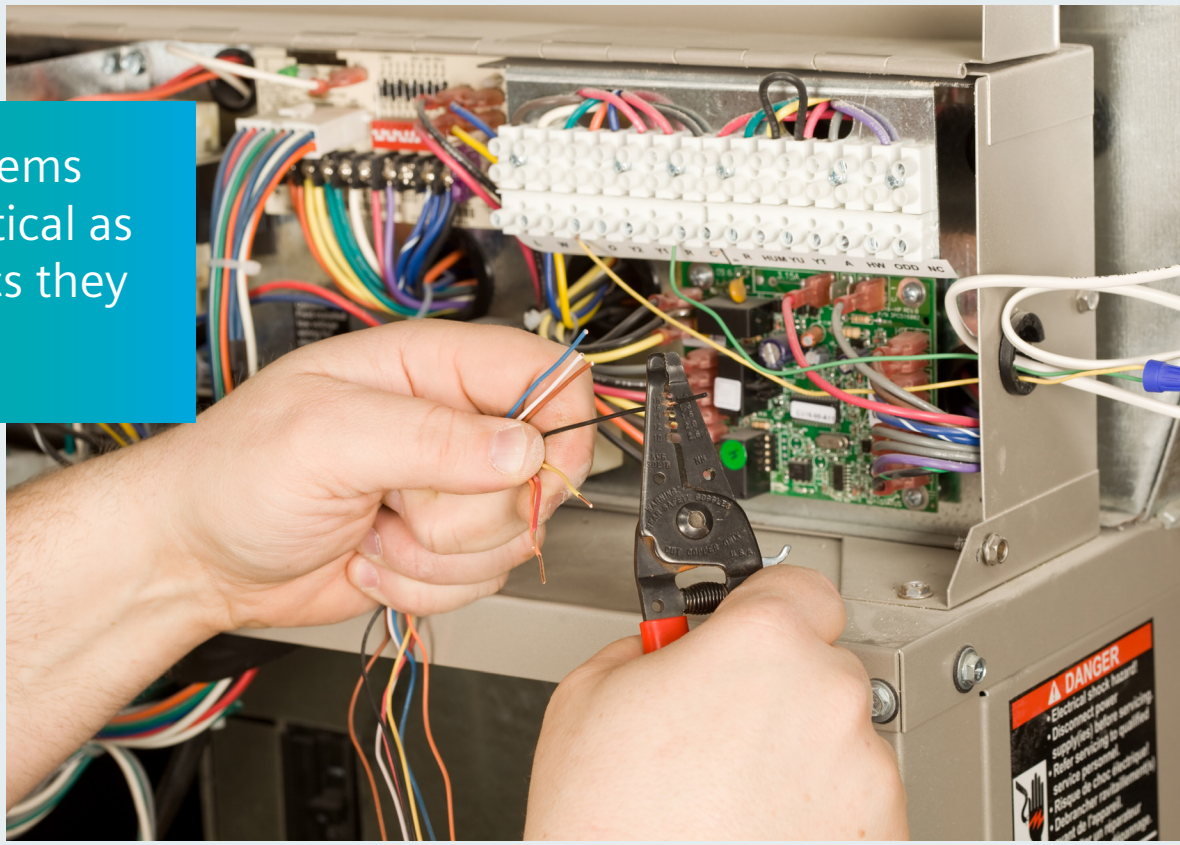

Electrical engineers must design the systems to meet specific requirements.

Constraints in the design process

Developing an electrical system is not as simple as plugging in a wire here and adding a connector there. Electrical engineers must design the systems to meet specific requirements. Wires must be sized to satisfy specific power needs and network demands while maintaining signal integrity. Components and connectors must be selected that comply with industry standards and regulations.

Once the electrical design is complete, the systems must be routed through the mechanical product, demanding close coordination with mechanical engineers to ensure that wires fall within necessary length specifications, or avoid electromagnetic interference while being passed through appropriate spaces in the product. Developing these systems is a highly constrained, exceedingly collaborative and very iterative process.

Developing electrical systems can be challenging for companies that traditionally develop mechanically focused products. Those companies are often unfamiliar with the design processes and procedures. They often lack the necessary knowledge, training and experience. They typically don't possess design tools to develop these systems. Yet, these companies are forced to quickly bridge those divides as they are pressured to join the IoT era and provide smart, connected products.

Simple, disconnected applications

Most companies seek to make the transition to develop smart, connected products quickly. This can lead them to use design tools that are simple and readily accessible, perhaps already available in their organization. These often include:

- General-purpose diagramming applications to develop the design of the electrical system
- 2D computer-aided design (CAD) applications to route wires and harnesses through the mechanical product
- Spreadsheet applications to build bills of materials and perform engineering calculations

Technically, this set of tools can be used to design electrical systems. However, they have shortcomings that expose the development process to significant risks.

- **Lack of intelligent connections:** With these three applications, a component can be placed in the electrical design, mechanical design and bill of materials. Yet, those three aren't connected or aware of each other. If the component is removed in the mechanical design, it must be also be manually removed from the other two. The same holds true of changes, such as modifying the color of a wire, switching a wire's pin, or other design adjustments. Manually matching changes across these three applications introduces a high risk of human error.
- **Lack of functional analysis:** Verifying the function of electrical systems is critical. Engineers may determine that a fuse blows when three switches are simultaneously flipped. The key is finding issues early, in design, as opposed to late, during testing. The three simple design tools do not provide any analysis tools to virtually validate the function of electrical systems in different states. That can introduce significant issues in development.
- **Lack of handoff automation:** Because these three applications share no integration, there is no automation in the handoff from electrical design to routing the system through the mechanical design. Mechanical engineers must manually review the electrical design to determine which wires to route where in the product.

Development schedules are short, and getting shorter. While these three applications are simple and readily accessible, they undermine a company's ability to stay on schedule and on budget.

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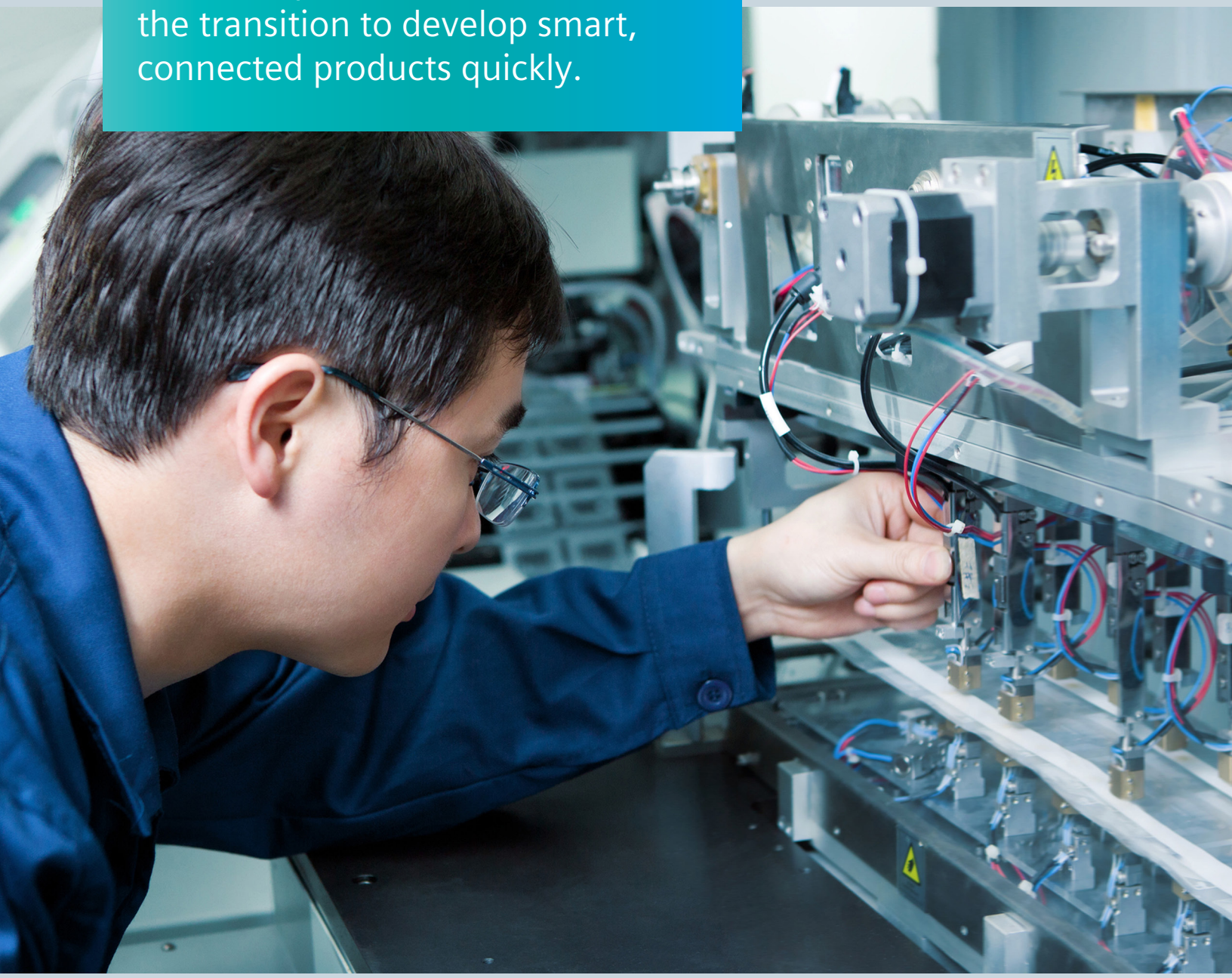


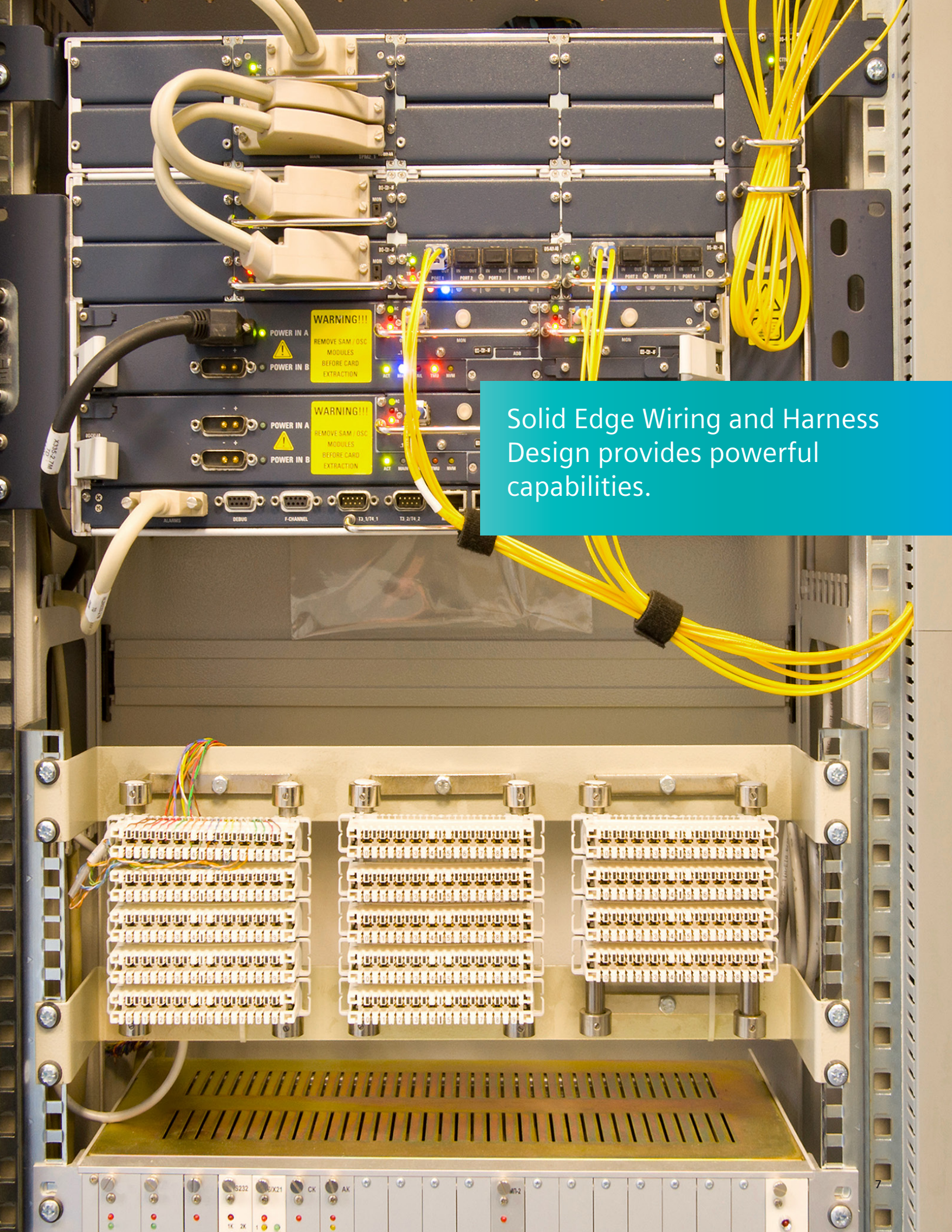
Solid Edge Wiring and Harness Design

- **Solid Edge:** a portfolio of affordable, easy-to-use software tools that address all aspects of the product development process. In the context of electromechanical systems design, it provides the 3D mechanical assembly for routing wires and harnesses.
- **Solid Edge Wiring and Harness Design:** software modules that enable engineers to develop electrical schematics and collaborate directly with the mechanical design to optimize the overall product design. The modules provide data continuity from schematic to harness layout, enabling correct-by-construction design.
- **Solid Edge Electrical Routing:** a dedicated process-driven environment for the efficient creation, routing and organization of wires, cables and bundles in Solid Edge assemblies.

In addition to the powerful capabilities of these applications, they are also tightly integrated. These two characteristics offer several significant advantages.

- **Intelligent deliverable associativity:** As items are added to one deliverable, they are intelligently included, as appropriate, in other deliverables. Adding a component to the diagram means it is also added to the corresponding 3D mechanical assembly and bill of material. A change to the color of a wire in the 3D mechanical assembly appears in the diagram and the bill of material. A change in one place is propagated everywhere. This dramatically reduces the potential of human error in development.
- **Automated functional analysis:** The Solid Edge electrical applications have intelligence about item types; for example, that a connector plugs into the pins on a component, or that a wire carries a signal from the pin on one component to the pin on another component. Because the underlying definition of the electrical system is created as items are placed in a diagram, it can automate the simulation functional states. You can specify that three switches are flipped and the application will tell you the fuse is blown. This kind of automation, based on embedded intelligence, makes it easy to run functional analyses. That, in turn, dramatically reduces the likelihood of errors getting downstream, where they can disrupt development.
- **Automated handoffs:** Because these applications are tightly integrated, the information of the electrical system is handed off as a set into mechanical design, providing a to-do list of routing wires for the mechanical engineer. Changes made in place are shared between disciplines, automating the design process and boosting productivity.

Solid Edge Wiring and Harness Design provides powerful capabilities that enable companies to avoid multiple rounds of prototyping and testing, maintain tight schedules, and keep costs under control while staying within budget.



Solid Edge Wiring and Harness Design provides powerful capabilities.

About Siemens PLM Software
Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of software solutions to drive the digital transformation of industry, creating new opportunities for manufacturers to realize innovation. With headquarters in Plano, Texas, and over 140,000 customers worldwide, Siemens PLM Software works with companies of all sizes to transform the way ideas come to life, the way products are realized, and the way products and assets in operation are used and understood. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

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