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Electromechanical design as it is meant to be

Solid Edge Wiring Design offers a seamless integration of ECAD and MCAD environments

Executive summary
Bridge the electromechanical complexity divide with industry-proven electrical design tools built by engineers for engineers. Solid Edge® software for Wiring Design enables the creation of fully functional and manufacturable designs in a seamless mechanical computer-aided design (MCAD) and electrical computer-aided design (ECAD) environment. When used with Solid Edge 3D CAD, the capabilities of Solid Edge Wiring Design allow companies to design and develop electromechanical systems quicker and more cost effectively.

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Abstract

Consumer demand for innovative electronics has resulted in an ever-increasing demand for a higher volume of electrical circuitry in new product design. What may have once been a mostly mechanical product has morphed into an electromechanical invention that contains software and wiring. However, regardless of the need to include wiring, and even electronic components, the amount of space physically available in a design often remains unchanged.

Technology allows engineers to be innovative, but the mantra of smaller, faster, lighter, denser and cheaper isn't music to a developer's ears. They are the ones dealing with the challenges of adding more wiring and circuitry into a small design footprint. Designing and optimizing electrical systems that work in a mechanical package can quickly become their greatest design challenge. An integrated, collaborative integration between electrical and mechanical domains can help. This white paper describes an effective collaboration environment that automates electromechanical design.

Digitalization unites engineering processes

Designing electromechanical products requires collaboration between electrical and mechanical design efforts. However, many small and medium-sized companies still work in silos with walls between development teams. Mechanical and electrical engineers are forced to negotiate at meetings, exchange volumes of documentation and still not truly know what each other is doing. As a result, problems arise, such as a lack of space for planned wiring, overheating, or, most often, a low-tech arrangement of structural elements resulting in a suboptimal design.

Digitalizing the development process is an excellent way to help address these challenges. Digital models can streamline engineering processes, and data can be added to the model throughout the product development lifecycle, as it moves from concept design to detailed design and through to simulation, manufacturing and service.

Using a digital model increases the overall level of automation, making it possible to carry out deeper design rule checks in real time. Digital data enables functional checks that can analyze product operability. It also allows you to effectively exchange data with other stakeholders for collaborative purposes. In addition, digitalization reduces the need to create and test physical prototypes, accelerating the product development process while ensuring the final product's reliability and durability. Everything happens on the basis of digital data.

The IDC report, "Digital Transformation in Product Design and Development: The Opportunity for SMB Manufacturers," indicates that 90 percent of small and midsize manufacturers allocate budgets for digital transformation, with core product development, design and engineering considered prime areas for investment. Greater access to powerful but affordable digital technologies is fueling this trend.

Solid Edge provides an excellent solution for manufacturers who want to start or strengthen a digital transformation. Solid Edge creates digital models, which may be used through the entire design flow, from concept to virtual prototyping to manufacturing.

Where can digital transformation take you?

A comprehensive digital twin represents and validates any design possibility by simulating its behavior. From a design perspective, a digital twin ensures that analysis, simulation, prototyping and testing can be done digitally, streamlining the entire engineering process.

Using models to capture relevant data for downstream purposes makes electromechanical design much easier than it was in the past. For instance, when used in electrical design, data in a digital model allows the developer to check a circuit for compliance with its specified requirements.

Digitalization enables optimization of both the product development process and the final product. Development time can be reduced by up to 50 percent by adding data to a digital model and leveraging that data through the product lifecycle.

Using a digital model for design is not a new idea. It's been used in MCAD for years. What's new is the level of automation that is now included in modern CAD software. Automated processes rely on the use of models to increase productivity and quality in a design.

A digital model makes it possible to analyze a product's operability, performing functional checks in real time as data is transferred between different environments. Functional checks can also be used for other purposes,

such as correctly selecting a wire's cross-section and determining a sufficient cross-sectional area of a core.

CAD systems have traditionally focused on mechanical design, with the main design efforts targeting the mechanical part of the product's development. But modern products are more complex and almost always include some level of electronics. As a result, it is imperative to obtain electrical information as early as possible to balance the requirements for mechanical design and electrical components, even if the main design emphasis is on mechanics.

In the early days of electrical design and analysis, a lot of design effort, such as defining wire lengths, was an intensely manual process. But as electrical design became more complex, the manual approach became impractical and tight integration between electrical and mechanical design was needed to address the requirement to have consistent and coherent models between the domains. This integration is achieved by creating a roundtrip interface between ECAD and MCAD tools, in which the ECAD tool contributes the connectivity information for each wire, along with other important attributes. The MCAD tool then routes the wires, cables or harness through the 3D physical space and sends the wire lengths back to the ECAD tool. This collaborative process enables faster design.
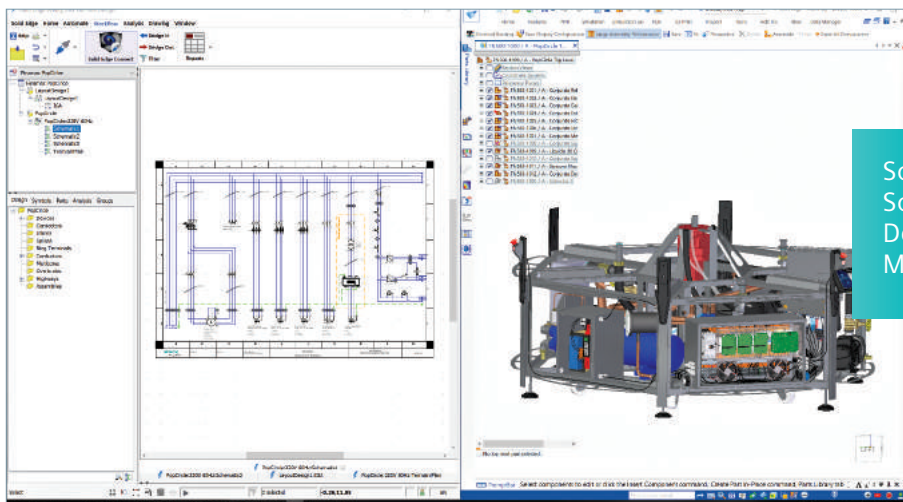
Solid Edge 3D CAD integrates with Solid Edge Wiring and Harness Design tools to create a seamless MCAD-ECAD environment.
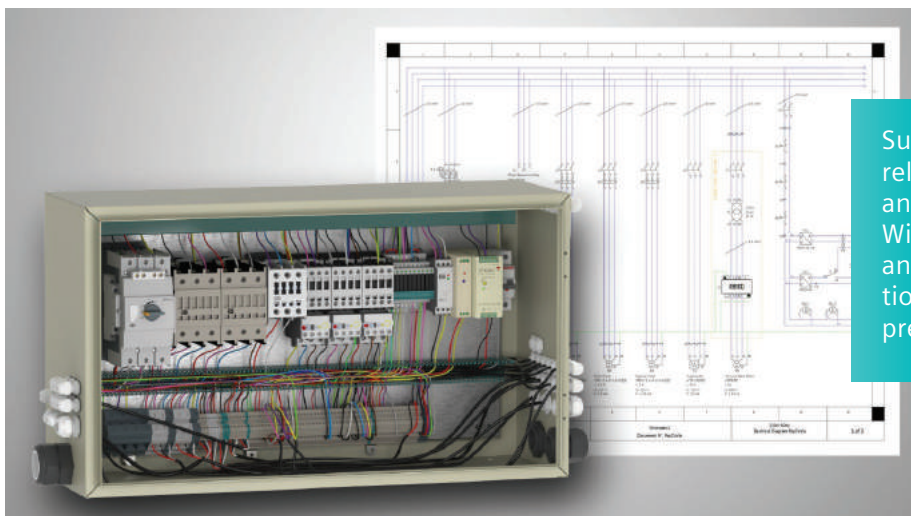
Solid Edge Wiring Design

Siemens, where today meets tomorrow, offers industry-proven tools that provide seamless communication between ECAD and MCAD domains. Solid Edge Wiring Design, part of the Xcelerator portfolio, a comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software, is a graphical design environment for creating wiring diagrams. With built-in intelligence that automates many design tasks, the software makes full electrical schematic development easy via an intuitive user interface, a library of electrical symbols and automated part selection. The software features built-in verification and design rule checks to validate design, eliminating errors faster and earlier in the design flow. It shows voltages and currents as the design proceeds, highlighting problem areas such as short circuits and validating wire and fuse size.

Solid Edge Wiring Design covers all the key tasks of automating the design of electrical circuitry, increasing productivity and reducing errors. Based on proven technology from industry leader Mentor, a Siemens business, this software enables you to design electrical systems while simultaneously collaborating with mechanical design efforts to optimize product design. This facilitates the accommodation of space reservation, clash detection and hazard avoidance in the mechanical domain.

Solid Edge Wiring Design allows users to easily accommodate the addition of electrical parts. It also enables the creation of fully functional and manufacturable electromechanical designs in a seamless ECAD/MCAD environment.

Of particular use is the simulation of the electrical circuitry provided by Solid Edge Wiring Design. With it, a manufacturing engineer can check the circuit's behavior for compliance with the specified requirements. In the process of developing simple electronics, this problem is not obvious but often arises in the design of moderately complex, multifunctional systems. Integrating various subsystems can cause unpredictable behavior of an entire system.

The Solid Edge Wiring Design environment also allows you to automatically prepare for production; that is, calculate all the data necessary for the specification and send it either to suppliers or to those directly involved in the production of cables and bundles. The software automatically generates reports for wires, connectors and devices used in the design. Diagram, device and wire index-tables, with full sheet and zone referencing, can be added to the drawings. These automatically update as changes are made.

Successful cabinet panel design relies on accurate physical layout and schematic drawings. Solid Edge Wiring Design includes configurable and re-usable layout design functionality, which can be used in the preparation of 2D control panels.

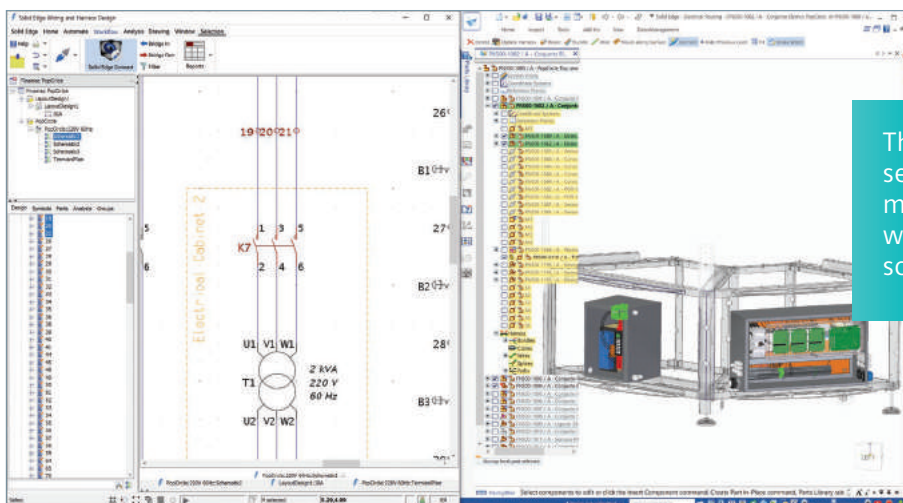# An example of effective electromechanical collaboration

In an integrated development environment, it is much easier to understand if a wiring connection is feasible or not, and how changes may affect the design. The partition can be a bearing, unchangeable, and can serve only as an additional element of structural rigidity. If the electrical engineer does not have this information, he or she has to then consult with the mechanical engineer.

Using a seamless electromechanical environment, such as Solid Edge Wiring Design with Solid Edge 3D CAD, allows both engineers to evaluate required changes collaboratively, with proposals highlighted in both environments. Designers can quickly evaluate whether wires can be shortened or whether they pass in a zone of elevated temperature or vibration. This allows correct reservation of space for electrical systems to be defined in the early design stages.

With Solid Edge Wiring Design, changes are visible to both mechanical and electrical engineers. When the color of a wire changes in the electrical part of the design, the colors in the mechanical model are automatically updated. It is easy to make changes: all elements are adapted and correspond to each other. Both engineers can work in parallel, exchanging information as required.

Once the design is complete, the next task is to produce its documentation. Solid Edge Wiring Design reduces the time required for drawing work. Without using automated processes, when the electrical engineer draws electrical circuits and then has to edit the design's documentation, he or she typically must make these changes manually while monitoring the correct images of the schematic. Solid Edge Wiring Design implements an automated adaptive style that frees engineers from detailed drafting work, leaving them to focus on getting products to market more quickly.

This view of the wiring in a seamless MCAD-ECAD environment makes it easier to understand what's portrayed in an electrical schematic.

Advantages of Solid Edge Wiring Design

Solid Edge Wiring Design comes with flexible libraries, giving companies the option to determine the necessary data for their own database of symbols to use in design. Libraries are also useful for documentation purposes. You can create a library of conditional images that will be automatically displayed on diagrams and produce documentation that strictly meets company requirements and standards. Thus, Solid Edge Wiring Design covers almost the entire spectrum of working design: from the creation of schematics to preparation for production.

Solid Edge Wiring Design integrates with the Siemens' Teamcenter® software product lifecycle management (PLM) system, allowing the direct transfer of data, as well as visual documentation, into the PLM environment. Companies that need to issue documentation in PDF format can use the Teamcenter workflow to obtain such documentation. Solid Edge Wiring Design can also interact directly with the Active Workspace Teamcenter interface. For example, if a design is created across geographically remote locations, Teamcenter can transfer data to other offices for re-use, interconnecting electrical and mechanical design efforts.

Conclusion

Solid Edge Wiring and Harness Design helps solve your electromechanical design challenges. The tightly integrated solution enables co-design across domains. And coming from a single vendor, Solid Edge Wiring Design provides an intimate integration that is not possible with third-party and private-labelled add-ons. When used with Solid Edge 3D CAD, the capabilities of Solid Edge Wiring Design allow companies to design and develop electromechanical systems quicker and more cost effectively.

Companies that use an integrated, electromechanical design process realize increased productivity and product quality. Automated digitalized processes reduce the overhead of data entry and drawing work, allowing engineers to diminish their dependency on an endless series of approvals, letting them focus on developing innovative solutions, optimizing design and increasing the competitiveness of development efforts.

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About Siemens Digital Industries Software
Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. The Xcelerator portfolio, a comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software, helps companies of all sizes create and leverage a comprehensive digital twin that provides organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software products and services, visit siemens.com/software or follow us on LinkedIn, Twitter, Facebook and Instagram. Siemens Digital Industries Software – Where today meets tomorrow.

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