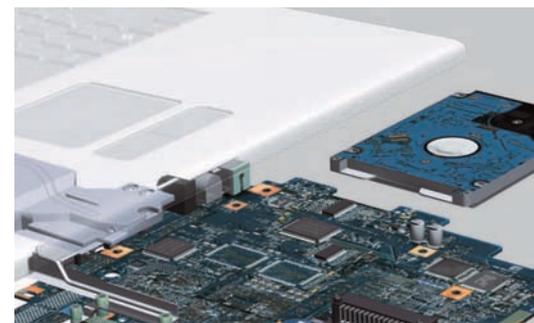
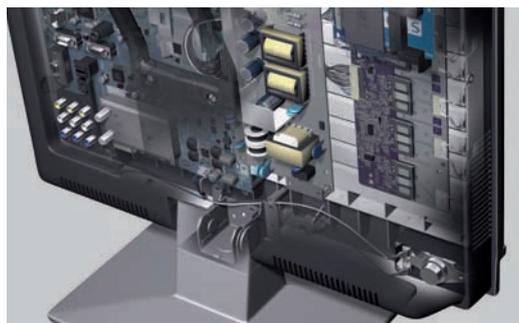
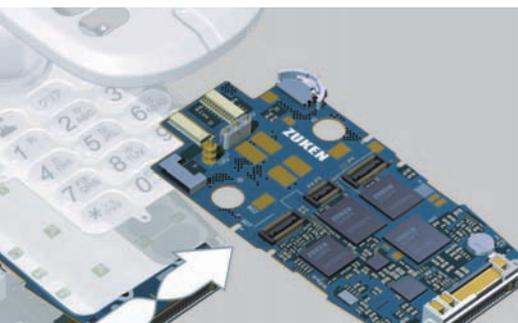


Concurrent Mechanical, Electrical & Electronics Design for Mechatronic Systems



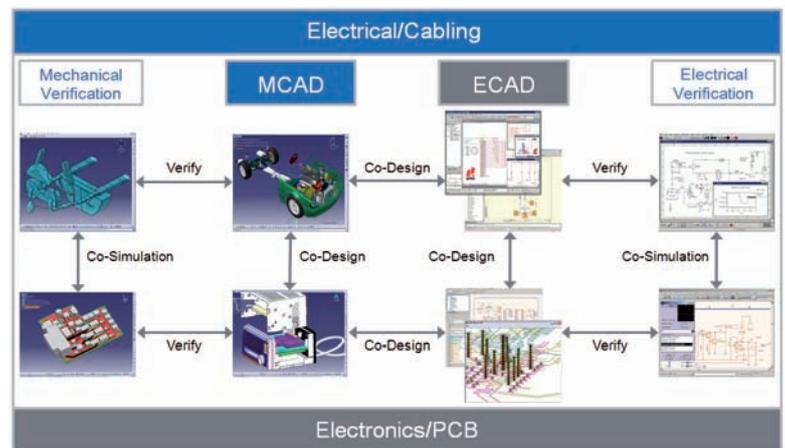
Introduction

Designing mechatronic systems such as industrial machinery, equipment, vehicles, or any device containing moving parts and electronically controlled actuators, is a challenging task. Success depends on effective use of sophisticated mechanical, electrical and electronic CAD tools. Traditionally, mechanical, and electrical and electronic design processes were separate; design data was exchanged between MCAD and ECAD systems at critical stages. Limitations in the data exchange, and lack of co-design functionality, resulted in extra design iterations, driving up development time and cost.

Zuken, provider of CR-5000 and E³.series, the most advanced electronics and electrical design platforms available in the industry, partnered with the leading MCAD system suppliers to develop ECAD/MCAD co-design tools which facilitate the interactive integration of ECAD and MCAD systems, and enable true concurrent mechanical, electrical and electronics design. The need for re-design due to undetected 3D issues during ECAD layout is thus eliminated, making right-first-time products much easier to achieve.

Since mechatronic systems integrate multiple technologies in a single system and combine electronics with electromechanical functions, constant verification of design performance at PCB, subsystem, and system levels is essential. Design reliability needs to be assured prior to production. Design performance and reliability need to be improved while reducing development and production cost. Manufacturing yields need to be predicted.

Zuken partnered with leading suppliers of physical and system verification tools to provide platforms for concurrent mechanical, electrical and electronics design and verification. Virtual prototypes can be investigated under a full range of test and verification scenarios, and all variants at multiple levels can be verified. Engineering processes are accelerated and quality is enhanced.



Concurrent mechanical, electrical and electronics design and verification work flow

Concurrent Mechanical & Electronics Design

With the integration of PCBs into ever more mechanically complex products, the trend to design and build products and PCBs on demand, and global product and PCB design and manufacturing, the traditional separation of mechanical and electronic design processes has become inadequate. To design first-time-right products, you need parallel and team-oriented ECAD/MCAD design processes.

ECAD/MCAD Design Collaboration

Interactive mechanical and electronics co-design of PCBs within a true concurrent flow is made possible by Board Interchanger, which integrates Zuken's board layout solution, CR-5000 Board Designer, with each supported MCAD system.

Mechanical product design

As the first step, the mechanical designer uses the MCAD system to define the shape of the PCB in the mechanical product, setting mechanical constraints and placing components such as connectors that have 3D positioning constraints. After completion of the mechanical product design, the mechanical designer extracts the PCB shape and height restrictions from the design, and exports them to CR-5000 Board Designer.

PCB layout creation

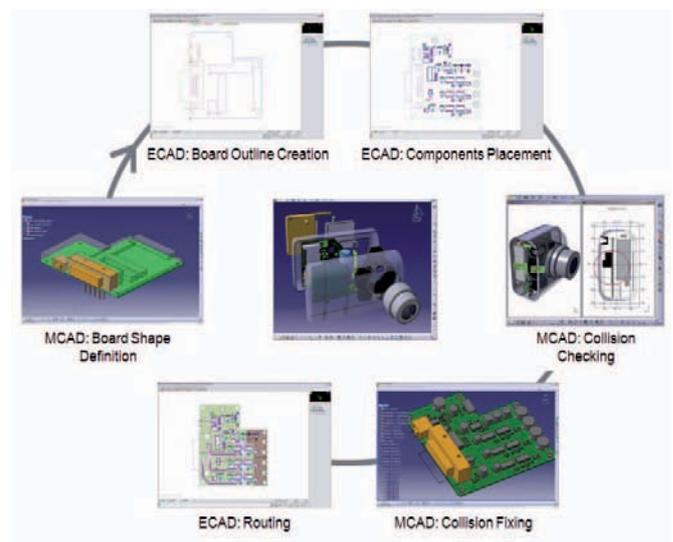
With the mechanical constraints readily available in Board Designer, after setting the required electrical constraints, the layout designer creates the board outline. Advanced automatic electronic component placement and routing, as well as signal integrity, power integrity, and EMC verification, is available for efficient PCB design. After completing the board layout, the layout designer applies automatic design rule checking, and forwards the board layout to the MCAD system.

Collision checking and mechanical design optimization

The mechanical designer now replaces the PCB shape by the board outline. Full 3D models are applied from the MCAD library to represent electronic parts and copper traces, so the mechanical designer can execute collision checking between mechanical housing and electronic components and traces. If there are collisions, the mechanical designer can move electronic components within the MCAD system, forwarding any changes to Board Designer, where the necessary re-routing and electrical DRC can be carried out. Finally, the mechanical designer executes mechanical DRC, and completes the product design.

Electronics Design in 3D

Zuken's interactive 3D ECAD tool, Board Modeler, also enables true mechanical and electronics co-design of PCBs. Board Modeler provides an optimized environment specifically for concurrent electronics design and mechanical verification of PCB layouts, significantly enhancing efficiency and accuracy. Board Modeler also interfaces with any MCAD system, and with supported physical verification tools.



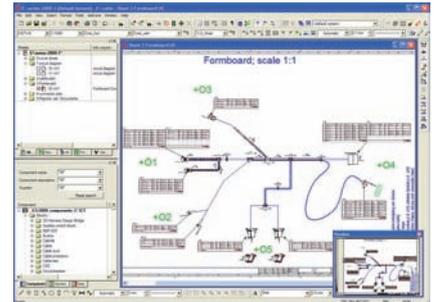
MCAD (CATIA V5, Board Interchanger) and ECAD (CR-5000 Board Designer) co-design work flow for PCB



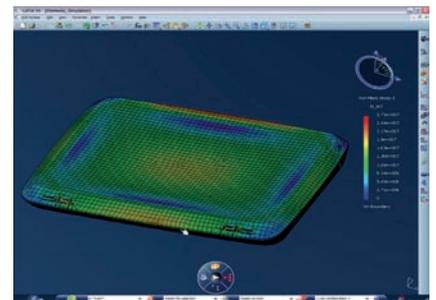
Concurrent Mechanical & Electrical Design

Zuken's logic-orientated schematic solution for the cabling of devices and vehicles, E³.cable, facilitates the connection of functional modules. The ability to display different views of cable connections or connectors on different sheets enables E³.cable to create assembly drawings or signal tables in addition to the block diagram. When changes are made at any place in the schematic all other views of the object are simultaneously updated. By using the automatic functionality within E³.cable you both save time and reduce the potential for human error. E³.cable enables the continuous and correct representation of cable harnesses. Physical information such as the definition of valid bending radii, can be documented easily.

The integration with MCAD systems is provided by the E³.3DRoutingBridge, which allows you to place cable harnesses within their mechanical environment. All relevant properties such as cross-section or dismantling are transferred to the MCAD harness design system. Individual devices are placed in their designated positions and routing paths are defined for the cable harness. Cable harnesses are then integrated into the 3D model, enabling mounting/fastening points and materials to be connected. An analysis of the virtual prototype checks whether valid bending radii are adhered to, or if the cable harness collides with any 3D elements. Values defined in the MCAD harness system can be quickly and easily back-annotated into E³.cable.



E³.cable ECAD/MCAD co-design work flow for cable harness

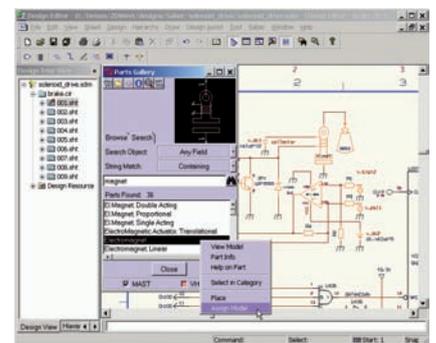


Physical verification of thermal stress induced by PCB in ultra portable PC enclosure (Abaqus, Board Interchanger)

Concurrent Design & Verification

The smooth integration provided by Zuken's ECAD/MCAD co-design tools, Board Interchanger and Board Modeler also enables concurrent verification of designs through physical and system-wide simulation. In the concurrent PCB design work flow, board layout structures can be exported into popular numerical simulation tools for mechanical, electrical or thermal verification. Simulation results can be easily back-annotated into CR-5000 Board Designer for design modifications.

The growing complexity of mechatronic systems demands concurrent system design and verification, including the testing of virtual prototypes under a full range of scenarios. At the PCB level, inclusion of both analog and digital functional blocks, and use of programmable devices such as FPGA, requires sophisticated simulation and analysis to ensure accurate and reliable performance prior to production. Zuken partnered with leading system-wide simulation platform supplier Synopsys to provide the integrated CR-5000 and Saber common PCB design and verification platform. A full system-level design and verification environment featuring the combined strength of CR-5000 and Saber. For verification of cabling harness designs, Zuken and Synopsys provide the integrated E³.cable and Saber common cabling harness design and verification platform.



Mechatronic system-wide simulation of control electronics (CR-5000 Framework)



Products



CR-5000

CR-5000 Board Interchanger

Zuken has partnered with leading MCAD system provider Dassault Systemes, integrating the interactive PCB design functionality of CR-5000 within Dassault's CATIA V5 solution. With Board Interchanger you can perform true concurrent mechanical and PCB design, making right-first-time products a realistic goal.

The integration of Zuken's CR-5000 board layout solution, Board Designer, with CATIA V5 is provided by the Board Interchanger interactive interface. For other MCAD systems, this solution will become available soon.



CR-5000

CR-5000 Board Modeler

Board Modeler provides an optimized environment for the verification of PCB layouts within their mechanical environment, avoiding re-spins and costly production delays. It also automatically back-annotates any board and placement changes, as board outline and restriction areas, into the new or imported PCB design, so any required layout action, like re-routing, can be done easily.

Board Modeler also interfaces with leading MCAD systems, and with physical verification tools, like Abaqus, Ansys, Cradle, and Flomerics, enabling in-depth simulation of mechanical or thermal stresses of a PCB.



E³
series

E³.3DRoutingBridge

The bi-directional E³.3DRoutingBridge allows you to place cable harnesses within their mechanical environment, with all device and connection data created and controlled in E³.cable. All relevant properties such as cross-section, color, material, additional length, code number, dismantling, are transferred to the MCAD harness design system.

E³.3DRoutingBridge supports Dassault's CATIA E³D & ECR, SolidWorks® Routing, Linius Embassy, UGS Harness Design, PTC Pro/E Cabling Design, and AutoDesk Inventor.



CR-5000



E³
series

CR-5000 Frameway & E³.Frameway

Zuken and Synopsys have integrated their respective PCB & cabling design and simulation solutions into common PCB & cabling design and verification platforms.

CR-5000 provides the most advanced PCB design capabilities available in the industry, and Synopsys Saber delivers the simulation, modeling and analysis capabilities needed for the concurrent design and verification of electronics for mechatronic systems. For cable harness design and verification, Zuken and Synopsys provide the integrated E³.cable and Saber platform.



About Zuken

The Challenge More quality, more functionality, in less time, with less cost; it's a common story in today's marketplace. Increased competition and requirements to operate on a global scale make these end-user demands ever more challenging. Companies need to be innovative and dynamic to stay one step ahead of the game – this is where Zuken helps.

What We Do Zuken is a global provider of leading-edge software and consulting services for electrical and electronic design and manufacturing. Founded in 1976, Zuken has the longest track record of technological innovation and financial stability in the electronic design automation (EDA) and ECAD software industry. The company's extensive experience, technological expertise and agility, combine to create world-class software solutions. Zuken's transparent working practices and integrity in all aspects of business produce long-lasting and successful customer partnerships that make Zuken a reliable long-term business partner.

Security of Solid Foundations Zuken is focused on being a long-term innovation and growth partner. The security of choosing Zuken is further reinforced by the company's people—the foundation of Zuken's success. Coming from a wide range of industry sectors, specializing in many different disciplines and advanced technologies, Zuken's people relate to and understand each company's unique requirements.

Software Solutions for Electrical & Electronic Engineering - *Our Focus, Your Benefit*

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