Mixed-signal and multi-technology simulation within the CR-5000 design environment

The CR-5000 advanced design environment from Zuken, is used by leading companies to create some of the world’s most complex PCB designs. The single, tightly integrated PCB design flow is used to meet the needs of medium to enterprise-wide electronics companies dealing with short cycle times and cost pressures. CR-5000 features a common user interface, common library management, and common electrical and manufacturing constraint management system, providing support for local or globally dispersed design teams to leverage their resources and reduce design cycle times. Integration of system design with Design Gateway, physical design with Board Designer, library management and synchronization with Component Manager, and manufacturing optimization with DFM Center facilitates seamless transfer of design rules and cross-probing between schematics and layout, thereby eliminating unnecessary and costly design iterations.

Mixed-Signal Simulation and Verification

During the PCB design phase engineers need to continuously evaluate the circuit to determine any value changes within discrete components or if the inclusion of a new device has altered the system. Design Gateway provides a comprehensive design definition environment, and the integration of the Saber simulation engine, from Synopsys, adds scalable board-level simulation and verification to help designers enhance product reliability. The Saber simulation engine is a single-kernel, mixed-signal simulator. The built-in event algorithm simultaneously accommodates event processing, Boolean logic, and continuous mathematical expressions and relationships to ensure accurate board-level simulation results. Saber can simulate analog, event-driven analog, digital, and mixed-analog/digital devices in the same simulation, while allowing interaction between analog and digital domains.
Benefits to PCB design engineers from the integration of Design Gateway and Saber include:

- Board-level design within a single schematic capture and simulation environment
- Extensive capabilities for co-simulation of mixed-signal designs
- Basic DC, frequency and time domain analyses as well as advanced parametric sweep and statistical Monte Carlo analysis
- Advanced simulation capabilities such as noise and stress analysis
- Full mixed-signal hardware description language (HDL)
- Support for industry-standard languages such as Verilog, VHDL, VHDL-AMS and MAST
- Interactive waveform post-processing functions with a wide range of display formats.

The integration of Design Gateway and Saber facilitates the automatic assignment of simulation models to components and the interactive creation of simulation parameters and stimuli. A great advantage of Design Gateway is the possibility to select a subset of the real circuitry that should be simulated and to introduce additional stimuli sources and virtual models for loads. A virtual model is used only for simulation purposes, and is ignored for PCB layout creation. Any functional block with the appropriate stimuli may be selected for simulation. After invoking a Saber simulation session, the waveform of all electrical signals within this functional block may be analyzed.

**Multi-Technology Simulation**

The Saber simulation engine is designed to analyze designs containing multiple technologies, while using the analysis units native to these technologies. These technologies or domains include:

- Mechanical and electrical
- Optical and electro-optical
- Hydraulic and pneumatic
- Magnetic
- Thermal
- Control systems
- Sampled-data systems
If device behavior can be expressed in mathematical terms, Saber can model and simulate from the system level to very detailed levels, including the interactivity between technologies. Any mix of technologies can be simulated concurrently, and all simulation results are output in the corresponding native units. The Saber simulation engine is also capable of co-simulation with specialized simulators such as Simulink to design the system control algorithms. Saber is then used to design the system hardware and Design Gateway encapsulates the system electronic design.

Integrating mixed-signal simulation and verification with Saber into the CR-5000 design environment

Design Gateway also enables the creation of multi-technology schematics, allowing the creation of a complete virtual prototype in one environment. Menu and icon-driven control of simulation and analysis is provided.

Assignment of Saber simulation models to Design Gateway components
Functional blocks within Design Gateway can be exported as a block symbol and associated with a Saber model for simulation. All electrical signals within the functional block and across the schematic, can then be analyzed using Saber.

**Frameway Integration**

Within the CR-5000 Saber Frameway Common Design and Verification Platform, Design Gateway is seamlessly integrated with Saber. All simulation menus, pop-up forms, design data models, symbols, schematics, and cross-probing capabilities, are available within the Design Gateway environment.

The Frameway integration facilitates the selection of a functional block within Design Gateway, and its export as a block symbol with an associated model directly to the Saber Symbol Library. Through the back-annotation mechanism, simulation results appear within the selected functional block in Design Gateway. These results may be utilized by various Design Gateway tools, such as Circuit Advisor for voltage and power checks of components.