Saber

Industry Standard for Multi-Domain and Mixed-Signal Simulation

Overview

To solve difficult mixed-signal design and verification problems, Synopsys' Saber® simulator offers a powerful mixed-signal behavioral simulator that efficiently handles architectural exploration through detailed design verification.

Introduced in 1987, Saber was developed by a team of simulation specialists, expert in both mathematical simulation and hardware design. Saber changed the status quo of analog simulation with a structure that supports both hardware description languages for modeling and a single-kernel mixed-signal simulation solution environment.

Application of improved solution methods and algorithms produced a faster, more robust simulator that is more widely applicable than anything on the market today. Saber continually raises the standard for analog/mixed-signal and multi-domain system simulation.

Benefits

- Analyze complete systems including electrical, mechanical, hydraulic, software-controlled systems, and other technologies as well as PCB designs
- Control simulation through an intuitive, graphical user interface
- Provide highly accurate and efficient results via single-kernel simulation of mixed-signal PCBs & systems
- Examine performance using steady-state, time, frequency, statistical quality, reliability and controls analyses
- Execute in popular electronic-design-automation (EDA) environments for interoperability, common modeling language, information sharing, and standard library support

Introduction

Saber simulator is a mathematical engine that solves the network of equations represented by models and their interconnections in a circuit or system. Simulator access is via a highly interactive and easy to use graphical user interface for analyzing designs, operating the simulator, and obtaining and viewing results. If you are primarily concerned with simulating a design, responsible for building the most accurate and comprehensive models, or just working in related applications, Saber simulator provides the simulation capabilities, features, and accuracy to complete the job accurately and on time.

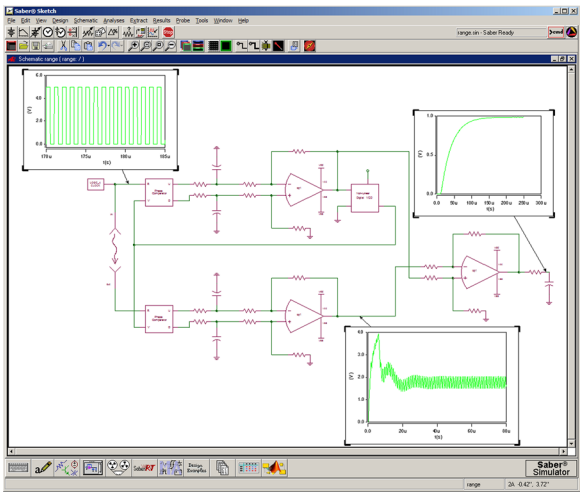

Figure 1: Saber Sketch is used for schematic entry and simulation control. The simulated results can be displayed in context with the circuit in 'probes'.

Mixed-Signal Functionality

Saber simulator is a complete, single-kernel, mixed-signal simulator. A built-in event algorithm, coupled with standard mixed-signal hardware-description languages (HDL) such as VHDL-AMS and MAST® and continuous-time, differential-equation algorithms are at the core of the simulator. Saber simultaneously accommodates event processing, Boolean logic, and continuous mathematical expressions and relationships for full simulation and system verification.

Saber simulator can simulate analog, event-driven analog (such as Z-domain), digital, and mixed-analog/digital devices in the same simulation, while allowing interaction between analog and digital domains.

To effect this linkage between analog and digital algorithms, Synopsys developed the patented Calaveras Algorithm. The Calaveras algorithm allows both simulation methods to operate at maximum efficiency, exchanging information only when required. For simulating designs that include models written in Verilog or VHDL, Saber simulator can be linked with popular digital simulators such as VCS-MX, Verilog-XL™, and ModelSim. Because Saber is inherently a mixed-signal simulator, the co-simulation connection occurs between Saber's digital engine and the partner simulator.

Multi-Domain Simulation

Saber simulator is designed to perform simulations based on very few preconceptions about the target system. Consequently, the simulator can analyze designs containing multiple technologies or engineering domains, using the analysis units native to these technologies:

- Electronic
- Power electronics
- Electro-mechanical
- Mechanical
- Electro-optical
- Optical
- Hydraulic
- Control systems
- Sampled-data systems

If device behavior can be expressed in mathematical terms, Saber simulator can model and simulate it all the way up to the system level with very accurate representation of system interactivity between the various engineering domains. Models can be created directly using the actual equations and relationships that govern the behavior of devices, not just idealized electrical macromodel equivalents. With Saber simulator, any mix of engineering disciplines or technologies can be simulated, and all results will be output in the corresponding units.

Robust Convergence Analysis

Saber's solution algorithms were carefully chosen to minimize the possibility of encountering convergence problems – the inability of simulators to arrive at a mathematical solution. Saber simulator uses multiple robust-solution algorithms, sequentially, to solve convergence problems. During system evaluation, Saber simulator performs a piece-wise-linear evaluation of the exact system of equations, with the resulting linear system being solved exactly. Difficult simulation problems, such as sharp signal transitions during transient analysis, are managed successfully allowing you to focus on the results.

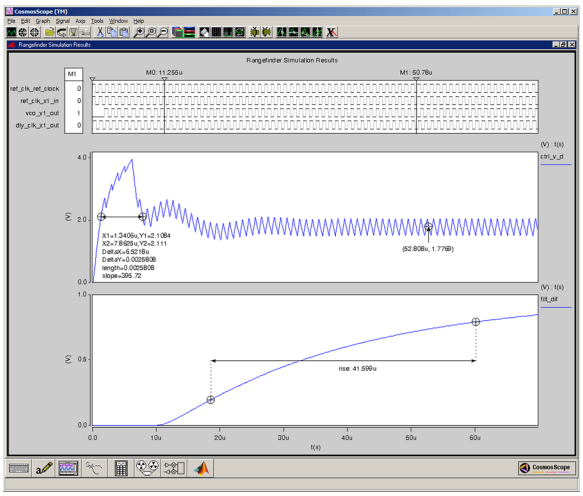

Figure 2: Saber is a true mixed-signal HDL-based simulator. No co-simulation is required to simulate complex mixed-signal systems.

Simulation Accuracy

When simulation is performed, engineers need confidence that results will accurately reflect the operation of the physical system. Built on Synopsys' design and simulation experience, Saber's default accuracy controls are balanced to provide highly accurate results with quick computation run times.

Modeling with Saber

With Saber, the simulation models can be developed in modeling characterization tools and run during simulation. This unique configuration allows full access to the models and the simulator at the same time to achieve optimal simulation performance.

A design engineer can view the contents of a model, make changes, or use it as the starting point for another model. Engineers can create new models and add them to libraries – or start a new library. Design engineers can use VHDL-AMS and/or MAST to develop models. In addition, an engineer can add models or subroutines written in C, C++ and FORTRAN.

Synopsys offers optional model libraries containing thousands of models for designing complete systems or high-power embedded control systems. These libraries include highly accurate device models as well as high-power silicon devices such as IGBTs and programmable S and Z-domain models for automotive, aerospace, and communications systems design.

Support for Popular CAE Frameworks

Saber operates within an easy to use graphical environment and can be integrated into design environments offered by Zuken, Cadence Design Systems, and Mentor Graphics through Synopsys Frameway Integration technology. A design engineer gains full and easy access to all features and capabilities of the Saber simulator even when accessed through the host provider's graphical environment.

Comprehensive Analysis Support

Because Saber is a mixed-signal HDL-based simulator it handles statistical and other analyses that are too difficult or impossible with other solutions. When combined with HDL-based models, Saber enables statistical analysis on any model parameters. The OpAmp input-offset voltage is a simple example of a parameter that is easily varied in Saber with a model template which is otherwise too difficult or impossible to vary with SPICE macromodeling techniques. The ability to vary digital parameters such as delay in a Monte-Carlo analysis is another example.

Saber simulator supports all the standard analog simulation analyses — DC operating point, transient and AC, noise, distortion, and Fourier spectral analysis. For more detailed investigations, Saber provides the ability to perform Monte Carlo, stress, sensitivity, Pareto, and parametric analysis. All analyses can be performed on systems containing any mix of technologies or physical domains.

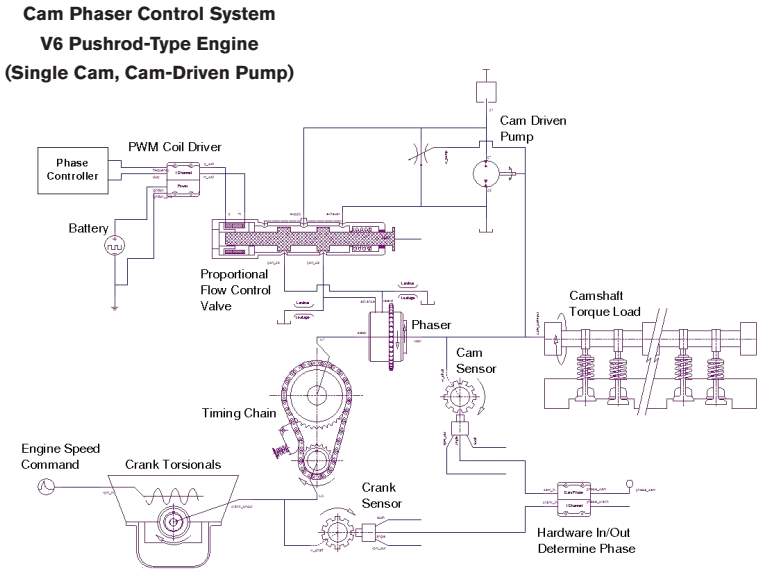

Figure 3: Saber simulates complex electrical designs or combinations of various engineering domains.

View the Possibilities

Generating simulation data is only one facet of successful system analysis. Within the Saber design environment, the graphical waveform analyzer allows easy-to-use viewing and analysis of results. Saber simulator creates a default results file in which specific simulation results can be extracted. Saber allows the designer to view signals and parameters deep within the hierarchy of a system or model, and to take a quick glance at primary waveforms. Additional details can be extracted without re-running the simulation, thus increasing productivity on the design instead of waiting on results. This unique feature saves simulation time and makes it easy to target the data most appropriate to a particular task.

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Platform Support

- Popular Unix
- Linux
- Windows

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.

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