

VisualSim Automotive Solution

Mirabilis Design is a Silicon Valley based software provider of system level architecture exploration and software-in-the-loop validation solutions. VisualSim Architect is a modeling and simulation environment used by designers to construct models, explore alternates, and evaluate results. VisualSim Automotive solution encompasses models of ECU hardware, networking components, AUTOSAR environment and a graphical Runnable software entry tool.





Key Features

- Integrated software solution for systems engineering and software validation in automotive networks, ECU and timing-critical software
- Analyze across the three axis of functionality, timing and energy using traffic and fault injected models
- Use pre-built parameterized automotive and system components to quickly assemble large and complex models for extensive "what-if" studies
- Automotive analysis-specific model templates provide foundation for rapid learning of the design challenges, analysis requirements and the nuances of the standard
- Export documentation for design specification sharing, analysis and optimization during development



Graphical System-level Design for Automotive Applications

VisualSim provides a graphical and hierarchical heterogeneous modeling and simulation environment to study timing critical software response, energy conservation and management, network topology design both for intra-vehicle and inter-vehicle communications, ECU hardware architecture and to conduct software validation.



Modeling Environment

This graphical modeling environment is used by systems engineers, researchers, and other designers to assemble models of their proposed automotive system, sub-system, ECU, network and software. This includes inserting probes, traffic patterns, and system faults in addition to simulating the operation over all scenario combinations. Based on the recommendation, the designer can validate and optimize the architecture. VisualSim Traffic generators emulate scenarios with varying rates and network messages, variable sized queues for intermediate nodes, and mixture of traffic generators. System faults modeled in VisualSim are network node/link failure, illegal intrusions, incorrect sensor behavior, memory value fault, incorrect scheduling, and peak power consumption. VisualSim probes are provided for functional timing, safety and reliability studies in the face of unpredictable errors, limited battery and generated power, and sensitivity to protection events. This analysis is critical when the result of one software task is needed by another periodic task, or when one task triggers another.

ECU Architecture Exploration

The hardware and software component library is used to construct multi-ECU system models with multi-core processors, peripherals, memory, buses, storage and interfaces. The models are used to make trade-offs on the number of cores versus power, software partitioning, and reduce the number of interconnects and gateways between different systems. These hardware platform models identify system bottlenecks, and performance degradation limits. The model drives the potential for higher level of component integration to improve fault tolerance and provide fail-safe operation of critical systems.



VisualSim Analysis Reports



Mirabilis Design Inc.



Network

VisualSim Automotive Networking Library provides the research and analysis reports to debug timing and bandwidth bottlenecks in existing multi-protocol networks. Using the prebuilt components, networks are assembled that capture syntax errors introduced by the user. Users can study the correctness of the network topology, study routing effects at the transition from one bus architecture to another, design gateways across domain boundaries and measure the latency for end-to-end sequence of tasks and messages. Analysis can help determine the network topology, computing requirements, queuing at each node, assignment of ECU to Nodes and software priority. The system model studies the effect of protocol stacks, class organization, TCP vs. multicast, load balancing and traffic scheduling.

For new technology, such as network authentication, the extended library components can be used to select the right scheme, determine processing resources and evaluate the system impact of additional latency.



VisualSim Analysis Reports



Autosar

The AUTOSAR modeling and software validation platform can be used by safety engineers, advanced development teams, AUTOSAR consortium members and software integrators to evaluate software *runnable* operation across multiple ECUs.

The AUTOSAR modeling environment provides end-to-end functional simulation with fault injections. The simulations, test whether faults intended to be addressed per the ISO 26262 safety standards, are being properly detected and mitigated by the configured AUTOSAR system. The AUTOSAR environment provides a graphical configuration of the BSW modules including the RTE (primarily generated), the (static) configuration of the OS (tasks, schedules, events, OS-Applications, execution time supervision, protection hooks, COM stack, and configuration of BSW modules such as the Watchdog Manager (aliveness supervision, deadline monitoring, program flow monitoring), and Diagnostic Event Manager.

The safety engineers will ensure that the various AUTOSAR services useful in building safety-critical systems are being used and configured correctly in a manner that will achieve the safety goals defined by the ISO team. The ISO Safety Team will conduct timing and memory analysis. These safety-critical analysis tests the schedulability of dynamic timing situations with fault-injection, validate the AUTOSAR configuration, identify testing requirements, develop test plans, and generate fault scenarios. AUTOSAR integration teams can conduct simulations of the final configurations to determine the cause of unexpected behaviors.

Advanced engineering can explore new design concepts and architectures. Examples are the role of multi-core processors in safety architectures, and the use of hardware virtualization (hypervisors) in achieving freedom from interference in safety architectures. Implementation artifacts for these new concepts or architectures might not yet exist, abstract models rapidly created in VisualSim provides significant visibility into system operation. AUTOSAR consortium team can model and simulate proposed new extensions to the AUTOSAR architecture to aid in the evaluation (acceptance vs. rejection) of new proposals.



New services for infrastructure health management, replication management, safety supervision and monitoring services could be proposed, modeled, and simulated against intended use-cases, and evaluated for effectiveness and resource consumption.



VisualSim Analysis Reports

Energy Conservation and Measurement

VisualSim Automotive Power Modeler provides a library of easy-to-understand components of the complex abstract mathematical equations and fuzzy logic power definitions. The library contains components for generation (battery, fuel cell, motor and



programmable), consumption (mechanical, electrical and electronics) and conservation (partial node, ECU shut-down, power modes, software- from the dynamic traffic simulation provide scenario-specific reports and provide significant higher accuracy over predictive and approximation models. The power probes provide visibility into the average and total power by device, application software task and subsystems. The power state and current consumption are based on the current activity of each device or sub-system in the vehicle. Using this environment, the designer can determine the energy consumed by a new platform, measure the benefits of a power management algorithm, and debug power control problems in the field.

Benefits

- Have complete knowledge of the expectations and operational response of system architectures prior to product development
- Select hardware and build redundancy based on the actual processing and reliability requirements, thus significantly controlling cost overruns.
- Save time and effort compared to verification on a hardware bench or in final vehicle tests
- ✤ Aim for "no surprises" during final vehicle verification
- Verify the safety mechanisms in an AUTOSAR-based design per the ISO 26262 functional safety process
- Providing executable specifications for implementation and Reusing test cases for validation
- Assess the suitability and value of new technology to achieve the target security, safety and reliability prior to selection decisions