# ARTEMIS™

For High Precision
Real-Time Simulation of
Electromechanical Systems

For users of The MathWorks' SimPowerSystems Toolbox (formerly known as the Power System Blockset) who need to accelerate their power system models or simulate them in **real-time**, **ARTEMIS™** provides enhanced algorithms that ensure reliable, accurate, and fast fixed step-length computations, essential for high fidelity, high-performance simulations. Unlike SimPowerSystems on its own, ARTEMIS was designed from the ground up to support real-time implementations of power systems simulations, dramatically improving **computation speed** while **preserving accuracy.**
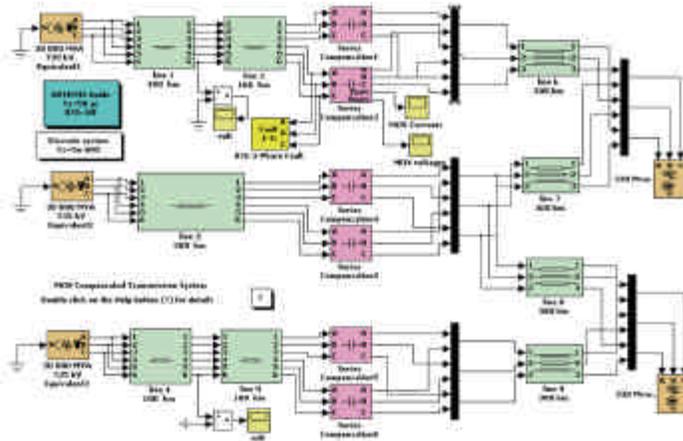
Variable-step accuracy with fixed-step performance

It is a fundamental constraint of real-time simulation that the model must use fixed-step integration solvers. In stiff systems like power electrical circuits, the traditional approach is to use a variable step solver for resolving the high-frequency components in the behavior of the system. Because the time to solve at each timestep is non-deterministic, these solvers have to be replaced with fixed-step solvers, which introduce errors into the solution.
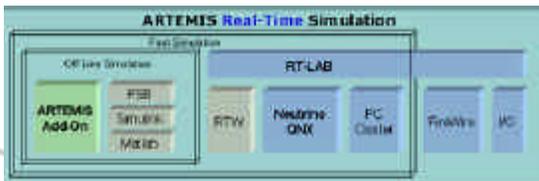

Fig. 1. ARTEMIS Operation Modes

ARTEMIS introduces innovative fixed-step solvers and efficient computational techniques that dramatically improve the computational performance of SimPowerSystems, to allow you to develop real-time simulations with your power systems models.

Because these are deterministic fixed step algorithms, you can create robust, accurate real-time simulations of your power system at significantly higher performance than

Key Features

· **Designed for Fast Simulation and Hardware-in-the-Loop Simulation**
- Fixed-time-step integration algorithms designed for real-time applications
- Compatibility with the Real-Time Workshop (RTW) code generator
- Compatibility with RT-LAB for distributed real-time execution on PC clusters

· **Higher precision for linear circuits with high frequency components**
- Improves the simulation precision

· **Better accuracy with nonlinear elements**
- Improves the simulation accuracy of systems with nonlinear elements

· **No numerical oscillations**
- Uses stable integration methods that are free from numerical oscillations

· **Easy to Install and Use**
- Drag-and-drop from ARTEMIS Toolbox available in the Simulink library browser
- Online documentation

Typical Applications

In conjunction with Simulink/SimPowerSystems, RTW and RT-LAB, ARTEMIS has been designed for real-time, hardware-in-the-loop, and other fixed-time-step applications in areas including:
· Electric drives
· Energy conversion system for hybrid vehicles and for industrial applications
· Power system design
· Control system design and testing
· Electricity generation, transmission, and distribution systems

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with SimPowerSystems without ARTEMIS. In fact, it has been shown that simulations can be more than 10 times faster than those done using the standard fixed-time-step methods, without the inherent errors associated with these solvers.

More power for less cost

The new solvers introduced by the ARTEMIS are proven to be highly accurate and stable over larger time steps than with the Trapezoidal fixed-time-step algorithms used by Simulink. Users can therefore get the same accuracy with less powerful and lower-cost systems, to give the performance needed for high-fidelity real-time simulation.

Optimized solvers for real-time simulation of power electrical circuits

Furthermore, ARTEMIS includes special power-circuit-specific algorithms for addressing typical problems encountered when converting your SimPowerSystems model to real-time. For example, for circuits with switches, ARTEMIS calculates all circuit topology matrices prior to running the simulation, and uses circuit-decoupling methods to reduce the size and number of these matrices, so that the computation runs smoothly in real-time, even when a switch changes state. Similarly, strategies to avoid algebraic loops and non-deterministic iterative calculations are included. These allow fixed computation times per step and interruption-free simulation in real-time.
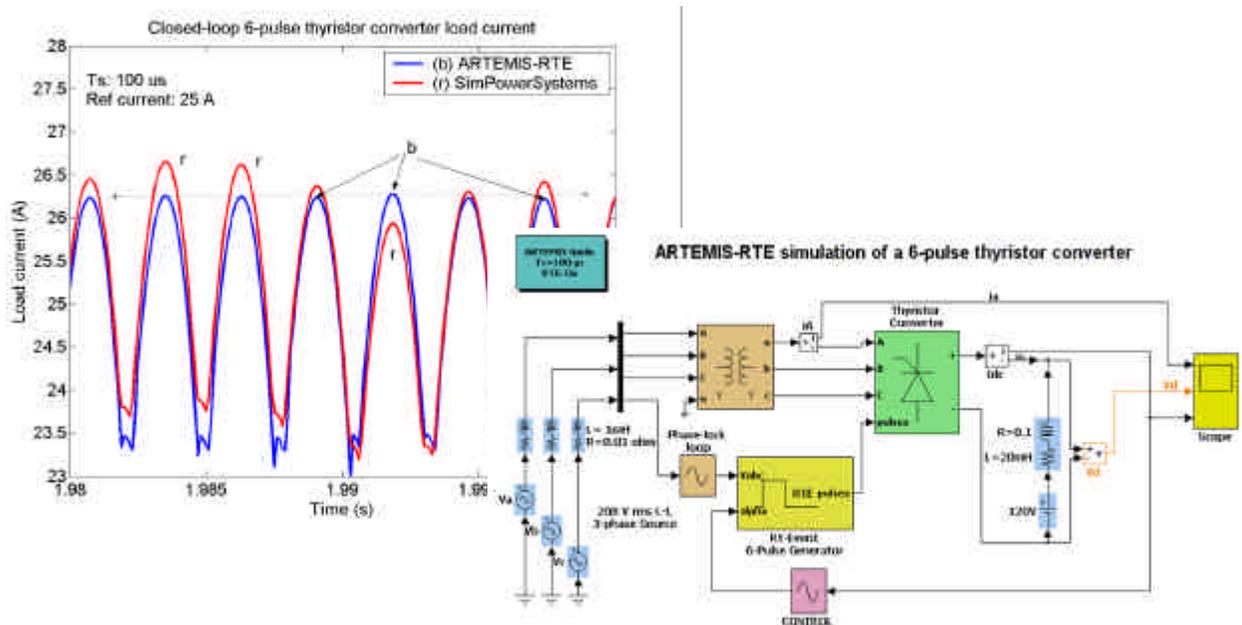
Create distributed real-time simulations on PC clusters with RT-LAB

ARTEMIS integrates fully into the Simulink environment in the form of a Simulink blockset, and is fully compatible with Real-Time Workshop (RTW) for real-time execution, or for simply accelerating the model.

This allows the distribution of a large, complex power systems model over several processors; in order to get the computational power required to achieve high-performance, real-time execution on low-cost, off-the-shelf PCs and non-proprietary hardware.

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