MapleSim™ is an advanced system-level modeling and simulation tool that applies modern techniques to dramatically reduce model development time, provide greater insight into system behavior, and produce fast, high-fidelity simulations.

**Reduce Development Time**
By combining modern physical modeling techniques with the world’s most advanced symbolic computation engine, MapleSim offers an environment in which you can develop high-fidelity system-level models significantly faster than with other tools.

- Easily construct and validate models using a model diagram that closely resembles the system diagram.
- Create multidomain system-level models by seamlessly combining components from different domains into a single model.
- Take advantage of revolutionary multibody technology that gives you unparalleled flexibility and control of your multibody models, making complex multibody models easier to develop and analyze.
- Create custom components easily, without programming, simply by specifying their representative equations.
- Incorporate CAD models in your system-level designs by importing CAD assemblies directly into MapleSim, automatically capturing the properties of the model components.
- Customize and expand MapleSim’s modeling capabilities through the open standard Modelica® modeling language.

**Develop Better Designs**
MapleSim, coupled with Maple™, provides a powerful, open analysis environment, giving you all the tools and flexibility you need to refine and optimize your designs.

- Take advantage of an extensive library of built-in analysis tools for sensitivity analysis, Monte Carlo simulation, optimization, and more.
- Leverage automatically generated model equations in full parametric form for open access to your models for advanced applications and analysis.
- Perform complicated operations at the click of a button or with a single command, including symbolic differentiation, symbolic integration, order reduction, variable isolation, and analytical solving of sets of equations.
- Easily script custom analyses using a powerful programming language designed for working with mathematical concepts.
- Access the underlying equations or Modelica code for components for deeper insight into the behavior, and modify them if desired.
- Capture all your project information into a single project file, including models, simulation results, analyses, and reports, combining your reasoning with your results and fully capturing the engineering knowledge that goes into each project.

**Get Extremely Fast Simulation Code**
MapleSim’s unique technology generates extremely fast, royalty-free model code for optimization and in-the-loop testing. With MapleSim, you can achieve real time the first time, without sacrificing fidelity in your system-level models.

- Achieve a computationally simpler set of system equations without loss of fidelity through symbolic simplification, including DAE index reduction, removing redundant operations, and eliminating algebraic loops.
- Dramatically speed up execution times with symbolic optimizations of generated code.
- Take advantage of automatically generated simulation code that is always royalty-free.
- Easily integrate code into popular real-time toolchains and other applications including Simulink® and FMI-compatible tools.
Block Library
MapleSim contains both physical component and signal-flow blocks. The physical component blocks include functionality for many domains:

- Electrical, including passive and active components, semiconductors, and electromechanical machines
- Thermal, including heat capacitors, conductors, convection, and radiation blocks
- Rotational and translational mechanics, including spring-mass dampers, gears, clutches, and bearings
- Multibody dynamics, including flexible beams, rigid bodies, and constraints
- Magnetics, including data for magnetic materials, electromagnetic fields, permanent magnets, field shapes, sensors, leakage, and flux and potential sources
- Thermal fluids, including boundary conditions, constraints, heat flow, heat transfer, and thermal sensors
- Hydraulics, including hydraulic cylinders and motors, orifices, and non-circular pipes

The signal-flow blocks include:

- Continuous and discrete blocks, such as filters, delays, and triggered samplers
- Logic and structural blocks, such as Boolean operators, switches, and mux/demux
- Arithmetic blocks, such as integrators, gains, vectors, and feedback

The block library can be extended by creating and sharing custom libraries, through specialized add-on products, and by importing third-party Modelica libraries.

Interface and Modeling
- Drag-and-drop block diagram modeling environment
- Model diagram maps directly to the physical system
- System equations generated automatically from the diagram and simplified using lossless symbolic techniques
- Components from different domains are seamlessly combined in the same diagram
- Shareable custom block libraries
- Import of Modelica libraries and models based on the Modelica 3.x standard library
- Masked subsystems and scoped variables
- Control over parameters and initial conditions of a single instance of a shared component or subsystem
- Hierarchical model diagrams with easy model navigation
- User-defined variables for component parameters
- Block diagram and 3-D model construction of multibody systems
- Equation-based custom components, without scripting
- To/From blocks to facilitate clean routing
- Data import and export, and lookup tables
- Access to underlying Modelica code for any component or subsystem
- User-created favorites palette for commonly used blocks
- Units-aware, including SI, US, and Imperial
- Library of prebuilt models across multiple disciplines

MapleSim Add-ons
- MapleSim Control Design Toolbox
- MapleSim CAD Toolbox
- MapleSim Battery Library
- MapleSim Driveline Library
- MapleSim Tire Library
- MapleSim Hydraulics Library® from Modelon
- MapleSim Server
- Connectivity add-ons for Simulink®, FMI, and many more

Simulation
- Stiff/non-stiff/semi-stiff and fixed/adaptive numerical solvers (Rosenbrock, Cash-Karp, Runge-Kutta-Fehlberg, implicit Euler)
- Linear, nonlinear, continuous and discrete time, SISO, MIMO, and hybrid systems
- Lossless symbolic simplification of system equations produce efficient, high-fidelity models
- Index reduction method for high-index DAEs
- Analytic solution of algebraic loops without user intervention
- Detailed error analysis for model construction and simulation diagnosis
- Compiled run-time mode for rapid execution
- Batch simulation, including the ability to run batch simulations and optimizations in parallel
- Parameter sets management tools
- Ability to call on external code as part of a simulation
- Snapshots for starting experiments at any time-step, even if the model was modified after the snapshot was taken
- Efficient models and optimized C code generation for fast real-time execution, including hardware-in-the-loop (HIL) applications
- Deployment directly to popular platforms from MathWorks®, National Instruments™, B&R, dSPACE®, and more through connectivity add-ons

Analysis and Documentation
- Extract, view, and manipulate the system equations for a model
- Parameter optimization and parameter sweeps
- Frequency domain and control analysis tools, including linear system analysis, sensitivity analysis, and Monte-Carlo simulation
- Data generation and signal generation tools
- Multibody analysis tools for extracting both kinematic and dynamic equations
- Full access to Maple for simulation analysis, visualization, and design documentation
- Scripting language for programmatic access to mathematical solvers, structures, and visualization tools for customized analysis
- API between MapleSim and Maple for programmatic analysis and testing
- Parameter management system for easily storing parameter sets, replacing groups of parameter values in a model, and comparing results
- Results management tools, including comparison of simulation runs on the same axes, instant plotting of both probed and unprobed variables, and easy creation of custom plots
- Live design documentation linked to model
- Include all related files in a MapleSim model for easy document management and sharing
- Natural math notation in analysis and design documents through Maple

Visualization
- 3-D visualizations and animations of multibody systems
- Automatic ball-and-stick rendering—custom geometry (including springs, cylinders, boxes, force and torque arrows, and path traces) and imported STL shapes can be added for realistic rendering
- Full playback and camera control on 3-D visualizations and animations
- Export of 3-D visualizations as .mpeg movies
- Customizable 2-D plots
- Multiple y-axes, and phase plots
- Log, semi-log, and linear axis scaling
- Pan, zoom and scale, point probe, and plot export
- Windows with multiple plots
- Drag-and-drop traces from one plot to another
- Full range of Maple plots available