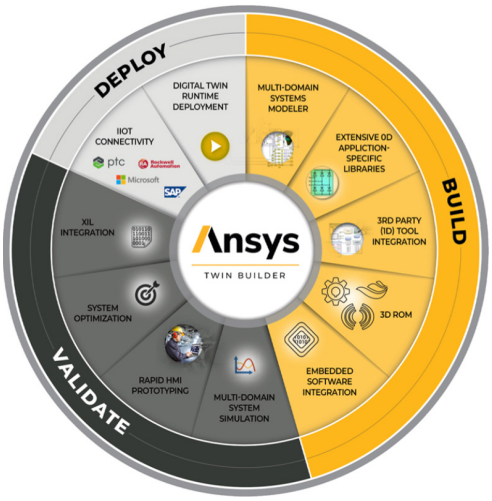
DIGITAL TWIN

Ansys Twin Builder

Simulation-Based & Hybrid Analytics

/ Build, Validate, and Deploy Simulation-Based Digital Twins



Ansys Twin Builder is a multi-technology platform that allows engineers to create simulation-based digital twins — digital representations of assets with real-world sensor inputs. Twin Builder improves predictive maintenance outcomes to save on warranty and insurance costs and optimize your product's operations.

To build your system quickly and easily, Twin Builder combines the power of a multidomain system modeler with extensive 0D application-specific libraries, 3D physics solvers, and reduced-order model (ROM) capabilities. When combined with embedded software development tools, Twin Builder allows you to reuse existing components and quickly create a systems model of your product.

To validate your system and ensure expected performance, Twin Builder combines multidomain system simulation capabilities with rapid human-machine interface (HMI) prototyping, systems optimization, and XiL validation tools.

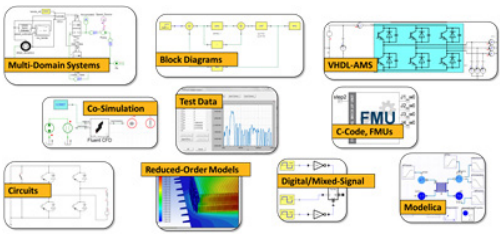
To connect your twin to test or produce real-time data, Twin Builder easily integrates with industrial internet of things (IIoT) platforms and contains runtime deployment options, allowing you to perform predictive maintenance on your physical product. It is the only product that offers a packaged approach for your digital twin strategy.

/ Build System Models and Digital Twins

Powerful Multidomain System Modeling

Create hierarchical schematics of complex power electronic circuits and multidomain system. Model with standard languages and exchange formats, including:

- VHDL-AMS (IEEE 1076.1)
- Modelica
- SML (Simplorer modeling language)
- FMI (Functional Mock-up Interface)
- C/C++
- Python
- SPICE

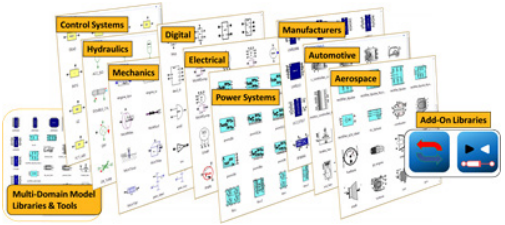


You can also:

- Use wizard-driven code editors to create VHDL-AMS, Modelica®, SML, C/C++, and SPICE models.
- Combine conserved (acausal), signal-flow (causal), and discrete event system behaviors.
- Use on-the-fly design checking tools to assure consistency of connection types and physical domains.

Access to Extensive Model Libraries

- Develop multidomain system models using built-in Modelica and specialized Twin Builder libraries.
- Model complete electrical/electronic systems with libraries of analog and power electronics components, digital and logic blocks, sensors, and transformers.
- Build battery cell models from hybrid pulse power characterization data with the Twin Builder Modelica library, which includes several templates for equivalent circuit models (ECM) with state of charge (SOC), temperature, and current dependency.



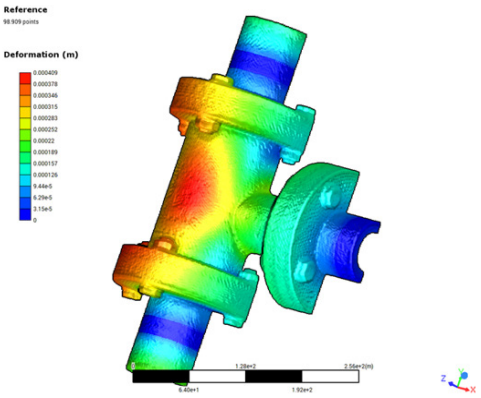
- Select from broad collections of characterized manufacturers and components, including power semiconductors, power management integrated circuits (ICs), magnetic devices, and ultracapacitors.
- Use add-on libraries, including the Twin Builder Heating and Cooling library, Twin Builder Fluid Power library, and EV Powertrain library.
- Use application-specific libraries for switch-mode power supplies, electric vehicle powertrains, and aircraft electrical power systems.
- Create and manage user and corporate model libraries with built-in graphical tools.
- Use wizard-driven graphical tools to create power MOSFET, Insulated-gate bipolar transistors, and diode components from datasheet information.

Model Exchange with External Tools

- Compatible with the FMI for model exchange to import models from all FMI-compliant tools and export Modelica models as functional mockup units (FMUs).
- Create or reuse C/C++ models with the Twin Builder C interface.
- Import MathWorks® Simulink® models using Simulink Coder™.

Reduced-Order Model (ROM)

- Use ROM interfaces to generate accurate, compact models from detailed 2D and 3D physics simulations.
- Visualize 3D fields with the ROM viewer directly in Twin Builder.
- Link to a variety of Ansys tools to create high-performing models for electromagnetic machines and actuators, circuit parasitics and cables, excitations for electromagnetic interference/electromagnetic compatibility (EMI/EMC), electronics thermal networks, signal integrity, general flow and heat transfer characteristics, and rigid-body dynamics.
- Multiple ROM generation techniques (including state-space, electrical circuit equivalent, singular value decomposition (SVD), and modal response) support a range of analysis requirements (linear or nonlinear, steady-state, or transient).



Integrated with Ansys SCADE Suite® for Embedded Control Software

- Use SCADE Suite to verify, optimize, and calibrate performance of safety-critical embedded control software.

/ Validate and Optimize Digital Twins

Robust Solvers

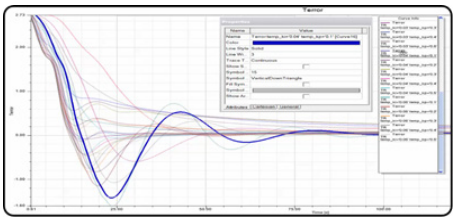
- Perform fast and accurate simulations of continuous-time, discrete-time, digital, and analog/mixed-signal behaviors.
- Achieve high numerical efficiency with sophisticated solver synchronization and adaptive time-step control.
- Connect to high-performance compute resources to increase throughput of simulation runs.

Basic Simulation Experiments

- Calculate steady-state, time-domain, and frequency-domain responses of the system.
- Create multiple analysis configurations with options for fine-grain control of solver settings.
- Replay simulations from existing results.

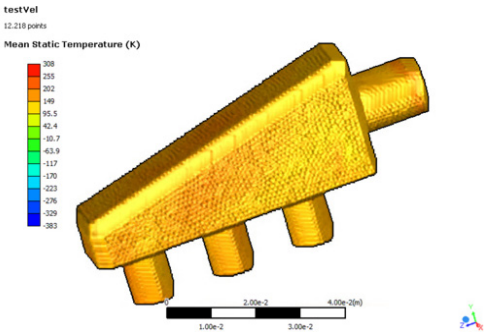
Advanced Simulation Studies

- Sweep parameter values within defined ranges to identify effects on system response.
- Optimize system performance based on cost functions of specified design variables.
- Determine the sensitivity of performance metrics to variations in model parameters.
- Analyze the effects of statistical variations (e.g., manufacturing tolerances, environmental uncertainty, etc.) on system performance.



- Change variable values interactively to tune performance of the model.
- Connect with Ansys Workbench™ to construct and manage simulation project workflows with 3D physics solvers.
- Use Ansys optiSLang to construct sophisticated design exploration studies.
- Analyze failure mode and effect analysis of electrified systems.

Analysis and Reporting



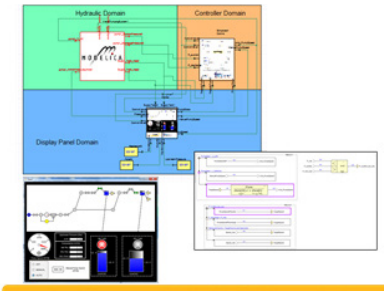
- Create or select from a broad range of graphical and tabular reports for displaying and analyzing simulation results.
- Plot time-domain and frequency-domain waveforms and parametric relationships in 2D and 3D.
- Display frequency-domain responses as Bode and Nyquist plots.
- Generate data tables and numeric displays.
- Display graphical reports directly on system diagrams and update them as the simulation progresses.
- Apply a range of transformations, markers, and measurements to waveform traces.

Export to Other Environments

- Quickly export diagrams, plots, and tables to Microsoft® Excel® or a variety of image formats.
- Automatically generate design summary reports in HTML.

Tool Integration and Customization

- Connect with SCADE Suite® and SCADE Display® for interactive white-box and black-box simulation with embedded control designs.
- Dynamically couple with Ansys 2D and 3D electromagnetic (low- and high-frequency), Computational Fluid Dynamics (CFD), and mechanical solvers.
- Build custom graphical panels with rapid prototyper to control and monitor Twin Builder simulations.
- Co-simulate with Mathworks Simulink Write or record Python or Visual Basic scripts to automate simulation workflows.
- Build custom toolkits with Twin Builder's comprehensive Python application programming interface (API).
- Add new model libraries and application extensions from the Ansys Customization Toolkit (ACT) store.



Seamlessly integrate Embedded Software for Control and Display

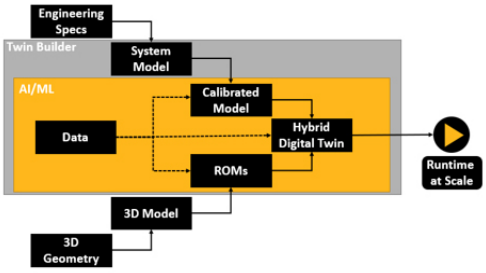
/ Deploy Digital Twins on IIoT Platforms

IIoT Connectivity

- Configure a connector to connect to an IIoT platform and send and receive operational data.
- Export from Twin Builder to generate portable, cloud-deployable twin for Microsoft® Azure® IoT, Microsoft Azure Digital Twins, PTC ThingWorx®, SAP Predictive Asset Insights, Rockwell Automation Emulate 3D, and Rockwell Studio 5000.
- Significantly reduce deployment time by performing validation and verification on twins with Twin Deployer.

Hybrid Analytics

- Ability to calibrate/tune simulation model parameters so the simulation outputs match data.
- Uncertainty quantification on parameters and outputs with the help of probability distributions and propagation.
- Choice of multiple algorithms to accommodate difficult parameter spaces.
- Supports both offline (driven by Twin Deployer) and online (driven by IIoT platform) scenarios for parameter calibration.



Export Scaffolding Code

- Export sample code from Twin Deployer to easily deploy twins on the cloud, edge, or offline.
- Develop quick web application prototypes by exporting web apps from Twin Deployer to view and interact with, then run simulations in a browser.
- Easily export a deployable container from Twin Deployer that contains a sample Python client application, demonstrating the usage of all APIs.

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