MathWorks®
Accelerating the pace of engineering and science

Wind Power

Information Kit

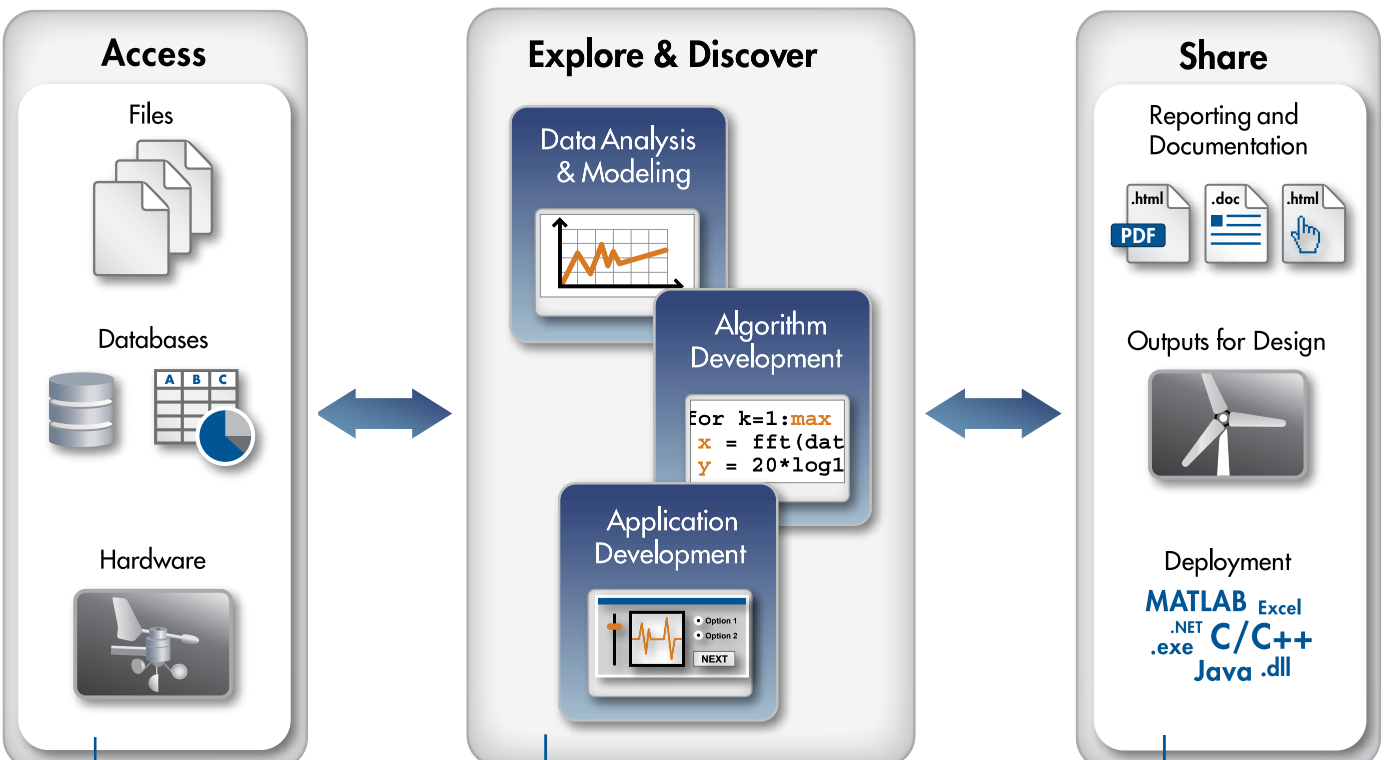
Contents

Workflow for Technical Computing

Harnessing one of the most abundant resources on earth requires the coordination of many disciplines. With MathWorks technical computing software, power engineers can:

- Analyze and predict wind conditions to optimize wind farm sites
- Monitor and process data to ensure wind turbine availability

» Learn more



- Data acquisition

- Data analysis
- Mathematical modeling
- Algorithm development
- Parallel computing

- Desktop and Web deployment

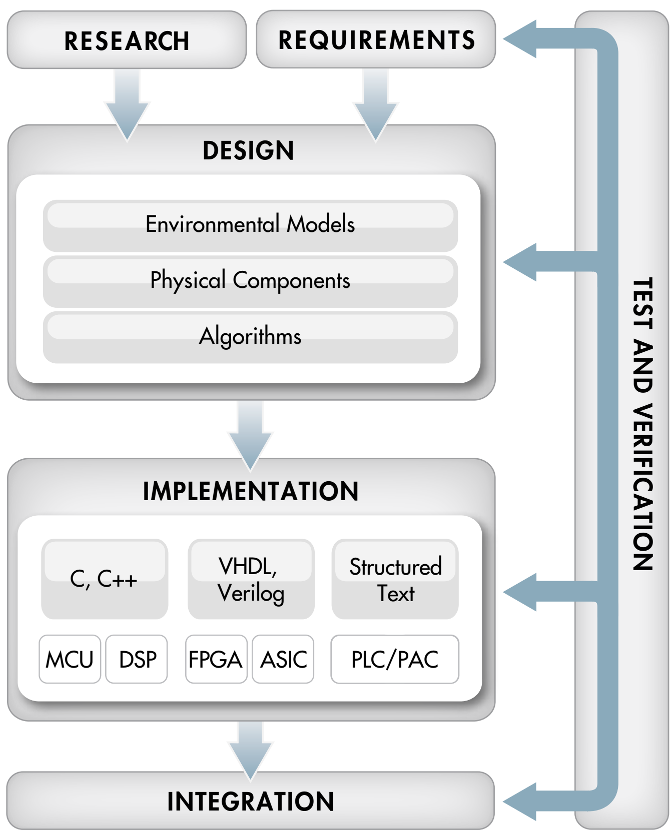
Workflow for Model-Based Design

Harnessing one of the most abundant resources on earth requires the coordination of many disciplines. With MathWorks software for Model-Based Design, power engineers can:

- Determine the proper voltage compensation to use wind farms into the electric grid
- Develop next-generation wind turbines

» Learn more

- System design and simulation
- Physical modeling
- Control system design
- Embedded code generation
- HDL code generation and verification



- Verification, validation, and test
- Rapid prototyping

User Stories

- **Horizon Wind Energy Develops Revenue Forecasting and Risk Analysis Tools for Wind Farms** » Read story

- **UNION FENOSA Predicts Energy Supply and Demand Using MathWorks Tools** » Read story

Technical Articles

- **Modeling Flexible Bodies in SimMechanics** » Read article

  In this article, SimMechanics is used to apply the two most common flexible body approximation methods to modeling beams: the lumped-parameter approximation and the state space/frequency response method using finite element analysis (FEA) results. Both methods assume that beam deflection is small and in the linear regime.

- **Simulating Mechanical Systems with SimMechanics** » Read article

  This paper systematically presents the mathematical and software developments needed for efficient simulation of mechanical systems in Simulink.

On-Demand Webinars

- **Applied Data Analysis Using MATLAB: "Catching the Wind"** » View webinar

  Learn how to use MATLAB for data analysis from data access through visualization and modeling. Using measured wind data for wind farm siting, MathWorks engineers will demonstrate the use of MATLAB and data analysis products for the entire data analysis and modeling process.

- **Developing Wind Power Systems Using MathWorks Tools** » View webinar

  Learn how developing wind turbines in a single simulation environment can offer significant improvements over a traditional development process. MathWorks engineers will demonstrate how to model a complete wind turbine including mechanical, electrical and hydraulic systems using Model-Based Design. Presented in four modules, the series covers:

  - Model-Based Design of a Wind Turbine
  - Determining Mechanical Loads for Wind Turbines
  - Designing Pitch and Yaw Actuators for Wind Turbines
  - Designing Control Systems for Wind Turbines

- **Investigating Reactive Power Management of Mixed-Technology Wind Farms Using Modeling and Simulation** » View webinar

  MathWorks engineers will demonstrate how modeling and simulation allows effective investigation of reactive power management within the context of a mixed-technology wind farm, with consideration of squirrel-cage and DFIG wind turbines. The demonstration will consider model abstraction techniques to improve simulation speed, including the use of average-value power-electronic converters and aggregated wind turbine representations.

Demo Videos

- **Integrating Physical Systems and Controller** » View video

  Detect integration issues when developing a wind turbine. Models of mechanical, hydraulic, electrical, and control systems are gradually integrated into a system-level model of a wind turbine, enabling engineers to test systems in isolation and to test overall system performance.

- **Analyzing and Documenting Results** » View video

  Automatically run tests on a wind turbine model and generate a report documenting simulation results. Simulink Report Generator™ is used to run tests, evaluate performance, and capture screenshots of the model and simulation results into a document.

- **Optimizing System Performance** » View video

  Use optimization algorithms to automatically tune the performance of a hydromechanical pitch control system in a wind turbine until it meets system requirements.

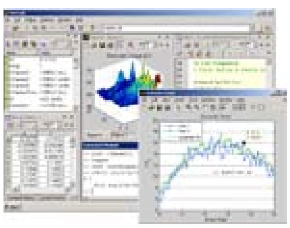
- **Real-Time Simulation of a Hydromechanical Pitch Actuation System** » View video

  Evaluate the performance of a hydromechanical system using real-time simulation before validating it with hardware prototypes. Real-time simulation offers a cost-effective way to test control strategies against realistic plant models.

- **Real-Time Testing Blade Pitch Control Systems Using Hardware-in-the-Loop (HIL)** » View video

  Use HIL testing instead of hardware prototypes to test control algorithms. A Simulink model of a wind turbine built with MathWorks physical modeling tools is converted to C code and downloaded onto Bachmann electronic M1 hardware controller.

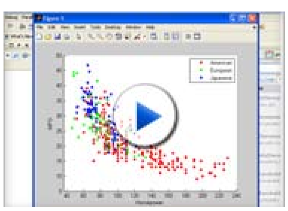
Key Products for Technical Computing



- **MATLAB** » Learn more

  The Language of Technical Computing

  MATLAB® is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran.

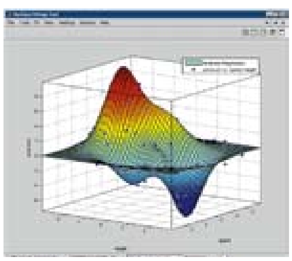


- **Statistics Toolbox** » Learn more

  Perform statistical analysis, modeling, and algorithm development

  Statistics Toolbox™ provides a comprehensive set of tools to assess and understand data. Statistics Toolbox includes functions and interactive tools for modeling data, analyzing historical trends, simulating systems, developing statistical algorithms, and learning and teaching statistics.

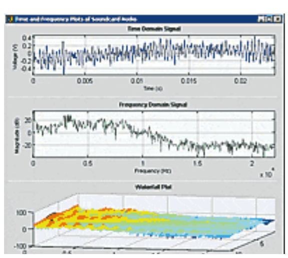
Key Products for Technical Computing



- **Curve Fitting Toolbox** » Learn more

  Fit curves and surfaces to data using regression, interpolation, and smoothing

  Curve Fitting Toolbox™ provides graphical user interfaces (GUIs) and command-line functions for fitting curves and surfaces to data. The toolbox lets you perform exploratory data analysis, preprocess and post-process data, compare candidate models, and remove outliers. You can conduct regression analysis using the library of linear and nonlinear models provided or specify your own custom equations. The toolbox also supports nonparametric modeling techniques, such as interpolation and smoothing.



- **MATLAB Compiler** » Learn more

  Build standalone executables and software components from MATLAB code

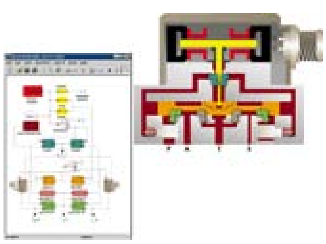
  MATLAB Compiler™ lets you share your MATLAB application as an executable or a shared library. Executables and libraries created with the MATLAB Compiler product use a runtime engine called the MATLAB Compiler Runtime (MCR). The MCR is provided with MATLAB Compiler for distribution with your application and can be deployed royalty-free.

Key Products for Model-Based Design

- **Simulink** » Learn more

  Simulation and Model-Based Design

  Simulink® is an environment for multidomain simulation and Model-Based Design for dynamic and embedded systems. It provides an interactive graphical environment and a customizable set of block libraries that let you design, simulate, implement, and test a variety of time-varying systems, including communications, controls, signal processing, video processing, and image processing.

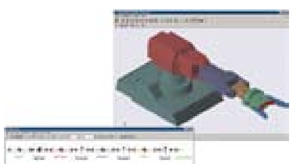


- **Simscape** » Learn more

  Model and simulate multidomain physical systems

  Simscape™ extends Simulink with tools for modeling systems spanning mechanical, electrical, hydraulic, and other physical domains as physical networks. It provides fundamental building blocks from these domains to let you create models of custom components. The MATLAB based Simscape language enables text-based authoring of physical modeling components, domains, and libraries.

Key Products for Model-Based Design



- **SimMechanics** » Learn more

Model and simulate mechanical systems

SimMechanics™ extends Simscape with tools for modeling three-dimensional mechanical systems within the Simulink environment. Instead of deriving and programming equations, you can use this multibody simulation tool to build a model composed of bodies, joints, constraints, and force elements that reflects the structure of the system. An automatically generated 3D animation lets you visualize the system dynamics. You can import models complete with mass, inertia, constraint, and 3D geometry from several CAD systems.

- **SimPowerSystems** » Learn more

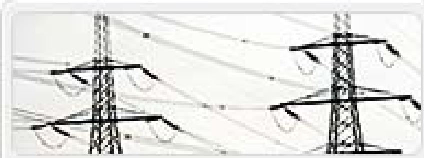
Model and simulate electrical power systems

SimPowerSystems™ extends Simulink with tools for modeling and simulating the generation, transmission, distribution, and consumption of electrical power. It provides models of many components used in these systems, including three-phase machines, electric drives, and libraries of application-specific models such as Flexible AC Transmission Systems (FACTS) and wind-power generation. Harmonic analysis, calculation of Total Harmonic Distortion (THD), load flow, and other key power system analyses are automated. SimPowerSystems models can be discretized to speed up simulations.

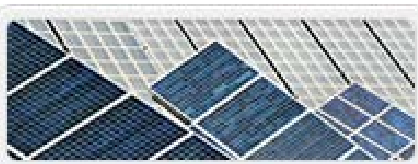
Additional Energy Segments

Engineers and scientists worldwide rely on MathWorks software to perform the challenging analysis, simulation, and product development tasks necessary to address the world's energy needs. You can use MATLAB and Simulink to evaluate energy resources, develop systems for power generation and distribution, model energy markets, and create products that consume less energy and are environmentally friendly.

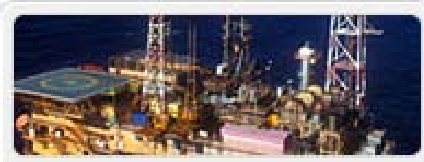
Electric Vehicles



Electric Utilities



Solar Power



Oil and Gas

Wind Power

Trading and Risk