

Simulink® Control Design 1

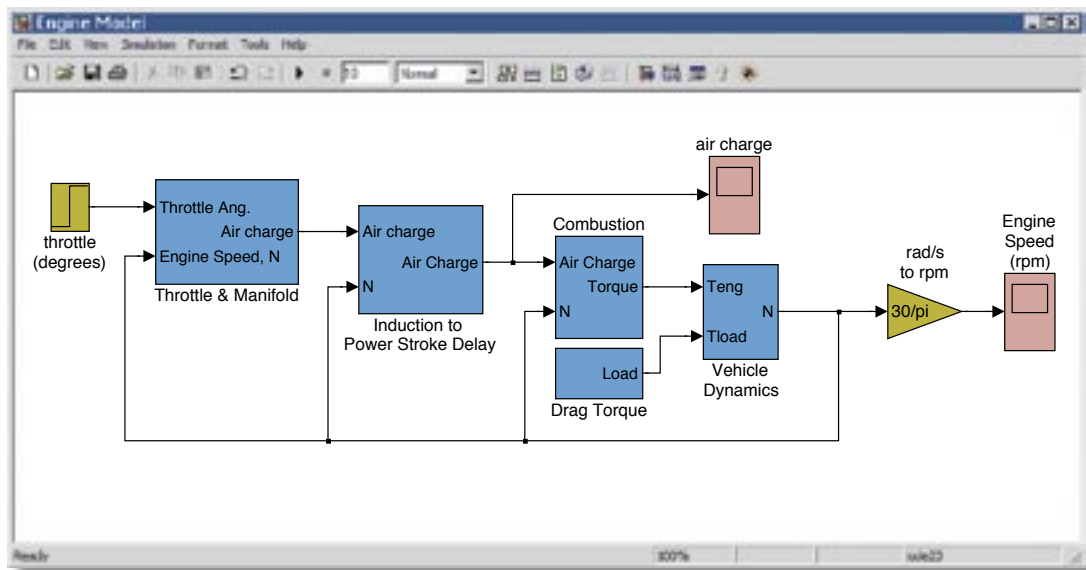
Perform linear analysis for control system design

Simulink® Control Design provides advanced functionality for performing linear analysis of nonlinear models. You can extract linear approximations of a model to analyze characteristics such as time and frequency responses and pole-zero dynamics. A graphical user interface (GUI) and programming capabilities reduce the complexity and time required to develop the linearized models.

Simulink Control Design eliminates the need for trial and error by providing a systematic method for designing controllers. This method takes into account the complex and coupled dynamics of many systems in the aerospace, automotive, industrial equipment, electronics, and process industries.

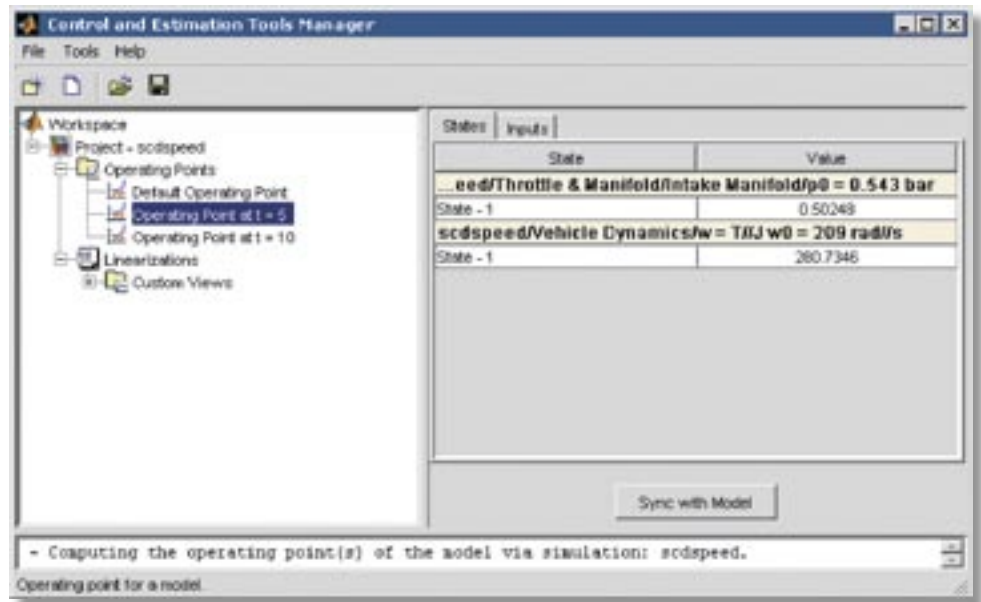
KEY FEATURES

- Graphical user interface to manage and organize the linear analysis process
- Nonintrusive point-to-point and open-loop analysis
- Linearization Inspector to examine linearization results block by block
- Calculation and management of operating points
- Command-line interface for developing automated linearization scripts and performing batch linearization



Simulink Control Design lets you perform linear analysis of nonlinear Simulink models.

The Control and Estimation Tools Manager guides you through the linearization process.



Working with Simulink Control Design

The Control and Estimation Tools Manager (the Simulink Control Design GUI) helps you manage, organize, and execute the linear analysis process. The GUI organizes multiple linearizations by model, block, and operating conditions, letting you evaluate scenarios using different operating conditions. It provides predefined views in which to analyze and compare results.

The Control and Estimation Tools Manager lets you:

- Specify and compute operating points
- Select model input/output (I/O) points
- Linearize the model
- Verify and analyze linearization results

Specifying and Computing Operating Points

Simulink Control Design provides several ways to determine operating points for the model. You can:

- Calculate steady-state operating points from user-defined setpoints using gradient-search and direct-search optimization methods
- Extract the operating points at specific times or events during a model simulation
- Import operating points from the MATLAB workspace, a file, or another linearization project
- Specify known operating points

Using the Optimization Toolbox (available separately), you can also use nonlinear least squares optimization methods.

Selecting Model I/O Points

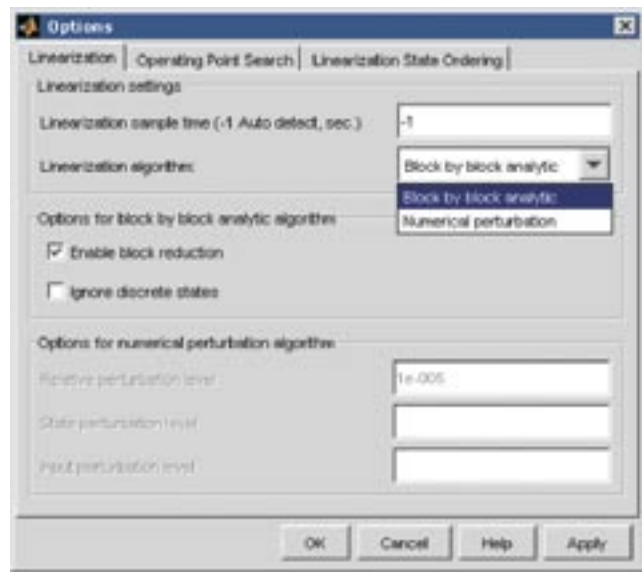
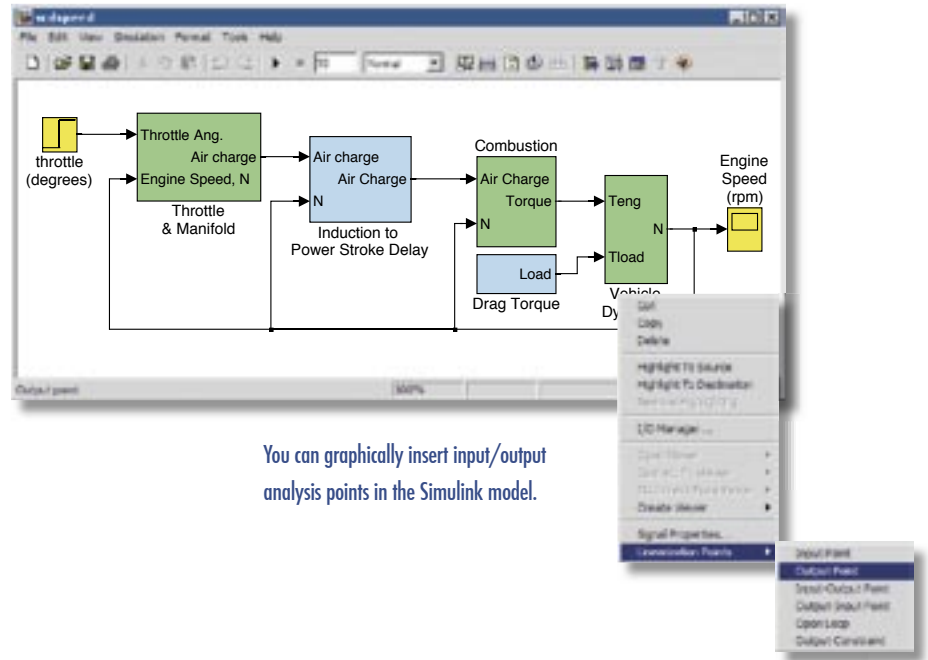
With Simulink Control Design, you can insert I/O points on any output data port of a block to define the inputs and outputs of the linearized model. You can place I/O points to linearize the whole model, portions of the model, or model subsystems. Using the Control and Estimation Tools Manager, you can view and configure the I/O points.

You can also insert points to compute the open-loop response of a feedback loop, without modifying the model by breaking a signal path.

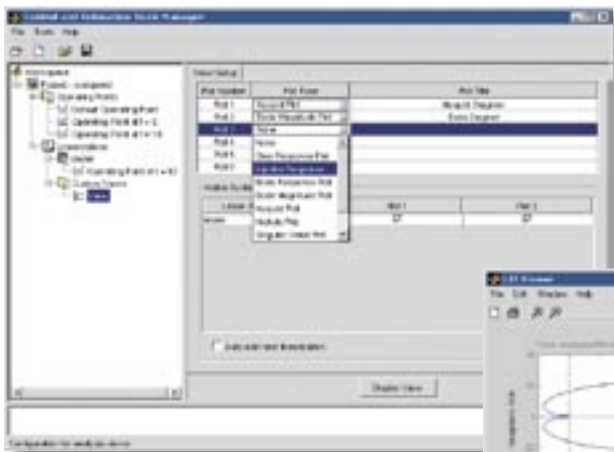
Linearizing the Model

Simulink Control Design enables you to linearize continuous, discrete, hybrid, and multirate system models. It lets you control the linearization process by:

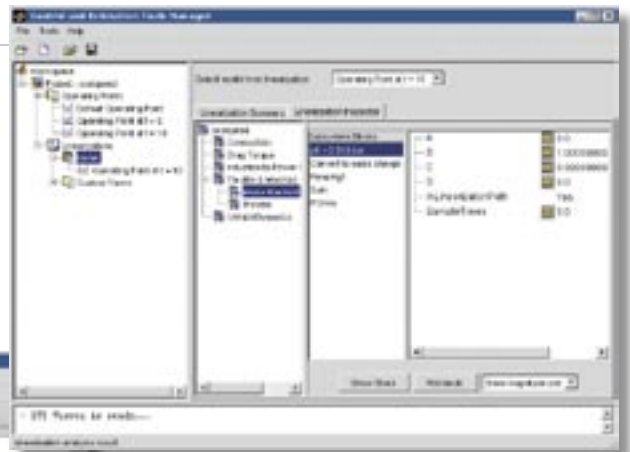
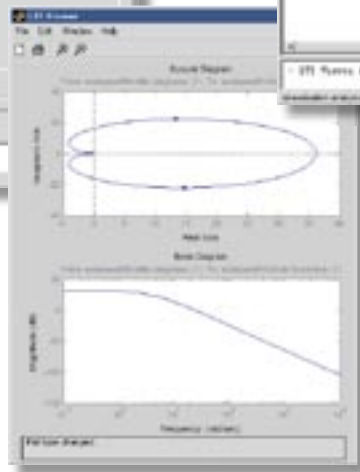
- Selecting multiple operating points about which to determine a linear representation
- Linearizing a single block or subsystem or computing the open-loop plant model seen by a controller
- Specifying either analytic or perturbation linearization methods
- Choosing preprogrammed options to handle blocks that are difficult to linearize
- Specifying perturbation levels for blocks without preprogrammed linearizations
- Automatically identifying blocks that do not contribute to a linearized representation
- Specifying the order of states in a linearized model



Simulink Control Design gives you control over the linearization algorithm.



A range of plots is available to analyze the results of the linearization.



The Linearization Inspector lets you examine the results block by block.

Verifying and Analyzing Results

Simulink Control Design provides a summary view and an inspector to verify the results of the linearization. The summary view shows the states involved in the linearization and provides hyperlinks to the blocks associated with those states. The inspector lets you view and plot each individual block linearization.

Interactive plots of the model response help you analyze linear representations. These plots include:

- Time-based step and impulse responses to discern oscillatory behavior and settling time
- Bode, Nyquist, and Nichols plots to analyze model resonance, gain, and phase margins
- Zero-pole plots to assess the model's stability and understand its dynamics

You can configure the plots to view combinations involving different linearizations and operating conditions.

Exporting and Saving Results

Simulink Control Design lets you export and save linearized models and operating points to the MATLAB® workspace to perform additional analysis. You can use the linear models for controller design in the Control System Toolbox and other control system design products. The controller can be added to the original model to assess its performance.

Required Products

MATLAB
Simulink
Control System Toolbox

Related Products

Genetic Algorithm and Direct Search Toolbox. Solve optimization problems using genetic and direct search algorithms

For more information about related products, visit www.mathworks.com/products/simcontrol/

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/simcontrol/

For demos, application examples, tutorials, user stories, and pricing:

- Visit www.mathworks.com
- Contact The MathWorks directly

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