Model-Based Calibration Toolbox Release Notes

These Release Notes introduce the new features in Version 2.0 of the Model-Based Calibration Toolbox, which is available as part of Release 13 with Service Pack 1.

See “Introduction to the Model-Based Calibration Toolbox” on page 1-2 for an overview of this product.

These Release Notes also discuss:

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Introduction to the Model-Based Calibration Toolbox

Note The Model-Based Calibration Toolbox Version 2.0 is part of Release 13 with Service Pack 1. Version 1.1 was the first release of this toolbox as part of a MathWorks release CD. The Model-Based Calibration Toolbox 1.0 was initially released in Web-downloadable form between Release 12.1 and 13. These notes describe changes introduced after Version 1.1 (see "New Features for Version 2.0" on page 1-3).

Feature Summary

The Model-Based Calibration Toolbox contains tools for design of experiment, statistical modeling, and calibration of complex systems. You can use these tools to systematically find optimal calibrations for increasingly complex powertrain systems. The toolbox can significantly reduce dynamometer testing time, increase engineering productivity, save calibration time and improve performance and reliability.

There are two main user interfaces:

- Model Browser for design of experiment and statistical modeling
- CAGE Browser for analytical calibration

Model Browser

The Model Browser is a flexible, powerful, intuitive graphical interface for building and evaluating experimental designs and statistical models. The Model Browser enables you to:

- Design experiment tools that can drastically reduce expensive data collection time
- Create and evaluate optimal, space filling, and classical designs, and constraints can be designed or imported
- Use hierarchical statistical models to capture the variability inherent in engine data, accounting for variation both within and between tests
- Build, compare, and evaluate statistical models and experimental designs.

- Build user-defined models using an extensive library of prebuilt model types
- Export models to MATLAB, Simulink, or CAGE.

CAGE Browser

CAGE (CAlibration GEneration) is an easy-to-use graphical interface for calibrating lookup tables for your Electronic Control Unit (ECU).

As engines get more complicated, and models of engine behavior more intricate, it is increasingly difficult to rely on intuition alone to calibrate lookup tables. CAGE provides analytical methods for calibrating lookup tables.

CAGE uses models of the engine control subsystems to calibrate lookup tables. With CAGE you fill and optimize lookup tables in existing ECU software using Model Browser models. From these models, CAGE builds steady-state ECU calibrations.

CAGE also compares lookup tables directly to experimental data for validation.

New Features for Version 2.0

Here are the enhancements for Version 2.0.

- Optimization capability for base map calibration in CAGE. For example you could mazimise fuel economy at a single point or over a drive cycle within emissions requirements, using Fuel and NoX models. You can perform multi-objective optimizations, such as minimizing fuel consumption while maximizing torque within emissions constraints. You can also incorporate your own algorithms in provided templates.
- Automatic fill of Tradeoff, using the optimization scripts.
- Boundary modelling for understanding complex operating envelopes using nonparametric surfaces.
- Stepwise improvements in terms of speed and large data set handling. Automatic stepwise is available for RBF models and prune as a stepwise option for all linear models.
- More efficient (size ~ 1000 to 10000 points) fitting and handling of large data sets is more efficient.
- New and improved Data Editor with increased functionality. There are new viewing options similar to the Design Editor so you can view your data in many ways simultaneously. You can now access the Data Editor to view and

export your modeling data from all nodes in the model tree. For example, this allows you to extract the value of MBT from all your local models and export them to the workspace. The Data Editor retains a memory of view settings.

- Improved multi-model tradeoff (one model for all sites, greatly reducing file size).
- Significantly faster CAGE evaluation.
- User-defined and transient models available as one-stage models.
- New Tree Regression methods for fitting RBF's.
- Local Multi-Models for site specific models. You can fit a variety of different models to each test and choose criteria to automatically select the best fit for each.
- Ability to fit the same model to all tests using Local Average Fit. This allows you to fit global models to your data while also being able to view the fit to each test individually.
- Support for more blocks in CAGE strategy parsing — all standard Simulink lookup tables and the relational operator block.
- Much improved data selection and matching to designs.
- New enhancements to design augmentation. You can easily use the data matching functions to add all your data to a design as fixed points, in order to augment the design and collect more data.
- Flexible summary statistics for models and you can use these criteria to automatically select best models, in addition to using them as diagnostic statistics when comparing models.
- Considerable usability improvements in the new Surface Viewer in CAGE.
- Memory of settings for a test plan retained by response surface, cross-section view, and validation data.
- Ability to display boundary models in Model Browser response surface viewer and cross-section viewer.
- Use of boundary models in CAGE (in the response surface viewer and optimization views).

Major Bug Fixes

The Model-Based Calibration Toolbox 2.0 includes several bug fixes made since Version 1.1. This section describes the particularly important Version 2.0 bug fixes.

If you are viewing these Release Notes in PDF form, please refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site and use the link provided.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Model-Based Calibration Toolbox 1.1 to Version 2.0.

You Must Uninstall Previous Versions of the Toolbox.

Important: you must uninstall any previous versions of the toolbox before installing version 2.0. If you have not done this incompatabilities will cause errors. If you have already installed the latest version without removing a previous version, simply uninstall version 2.0 and then reinstall.

You Cannot Load Version 2.0 Files Into Previous Versions

Files from earlier versions of the toolbox are fully supported in Version 2.0.

However, files saved with this new version will not load into previous versions.

Known Software and Documentation Problems

This section includes a link to a description of known software and documentation problems in Version 2.0.

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