Dymola 6
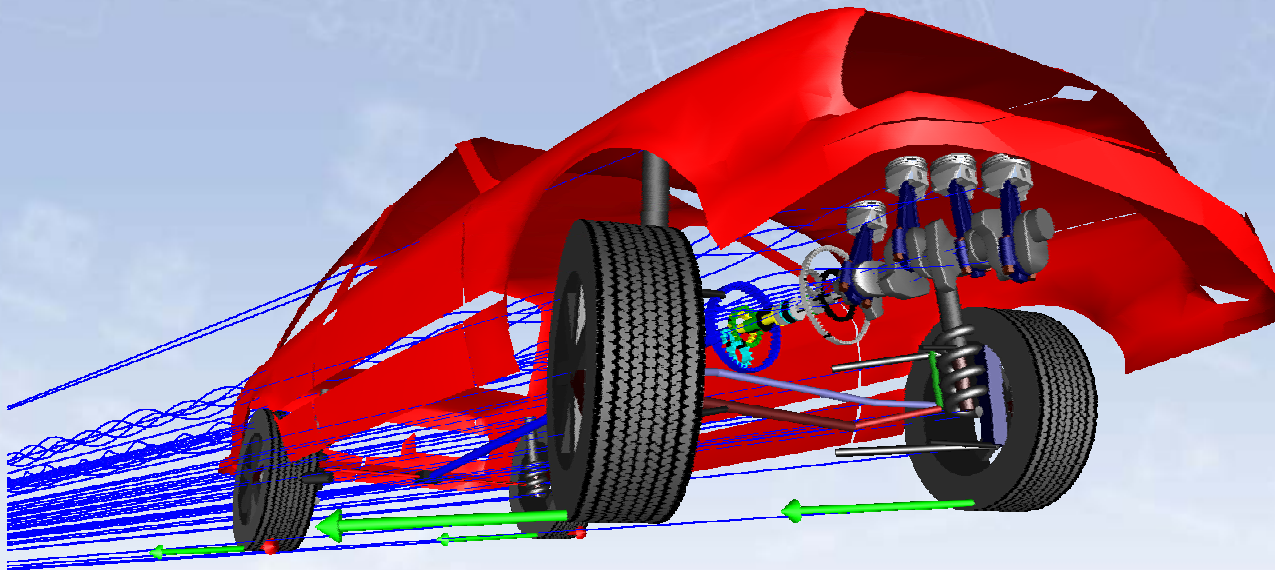
Dynasim AB, Lund

Highlights in Dymola 6

Model Calibration

Design Optimization

Model Experimentation

3D Visualization

User Designed dialogs

New scripting facilities

Model management

Model Calibration

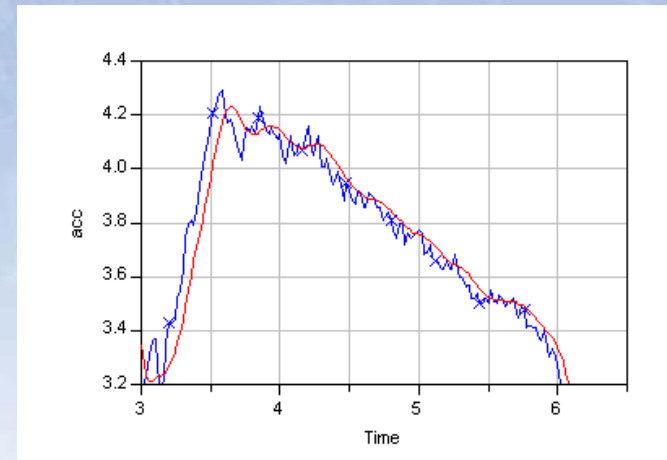Determine unknown model parameters from transient measurements.

Acceleration (BMW 645i)

Anti spin control

Gear shift

Source: Auto Mobil, Issue 2, 2005

Measurement data

- CSV files
- Matlab 4 mat files

Preprocessing data

- Detrending data
- Filter design and denoising
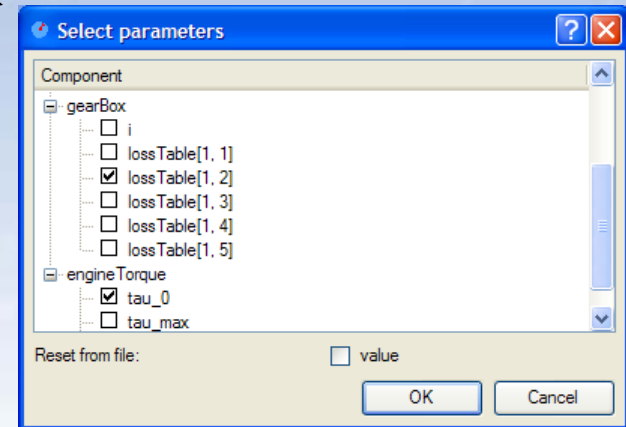- Limitating data

Easy setup
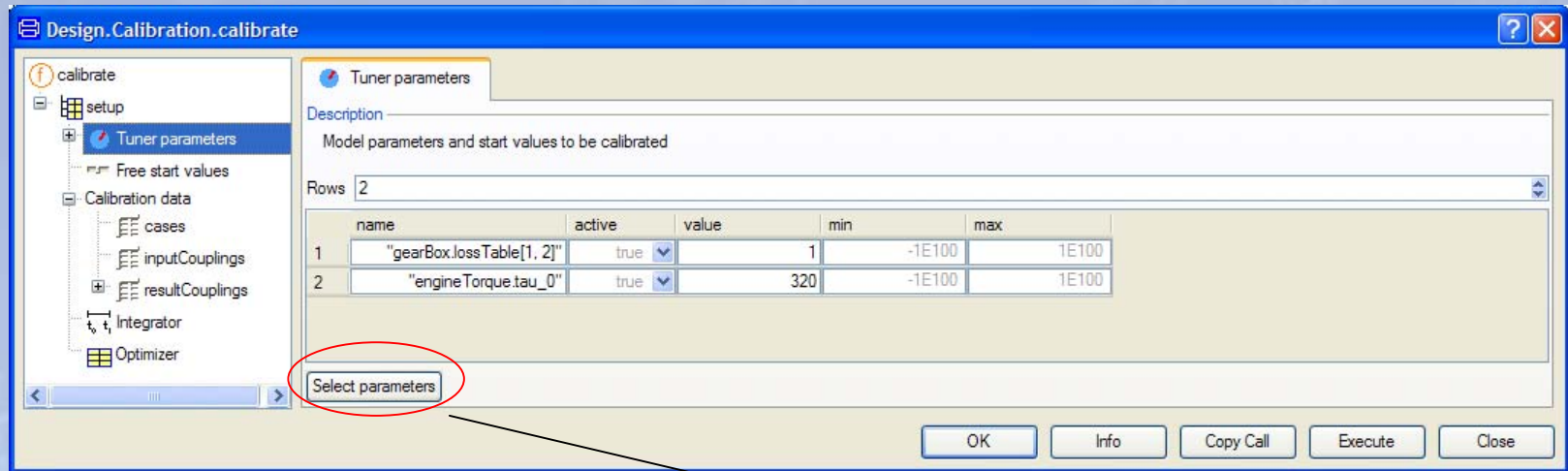
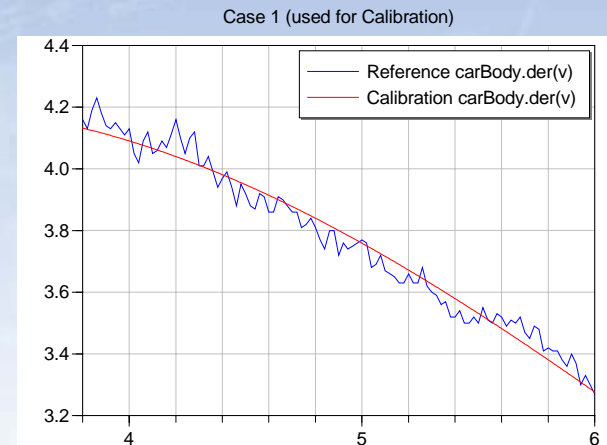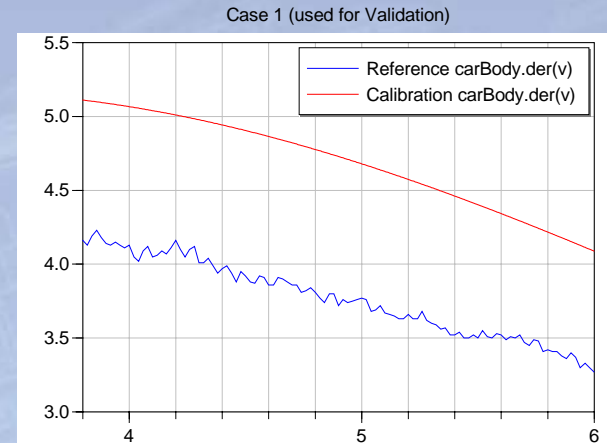Dialog with model, and data browsers to specify

- Tuners (parameters or initial values)
- Measurement files
- Couplings between model and measurements
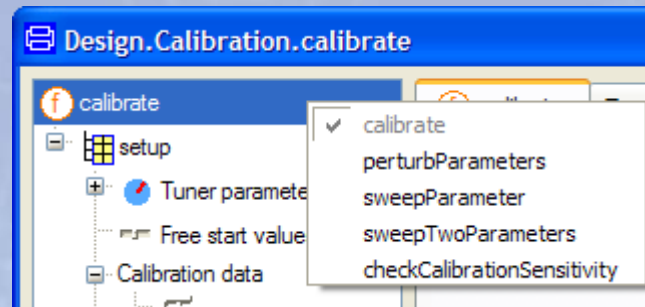- Case dependent parameters and initial values

Example: BMW 645i acceleration
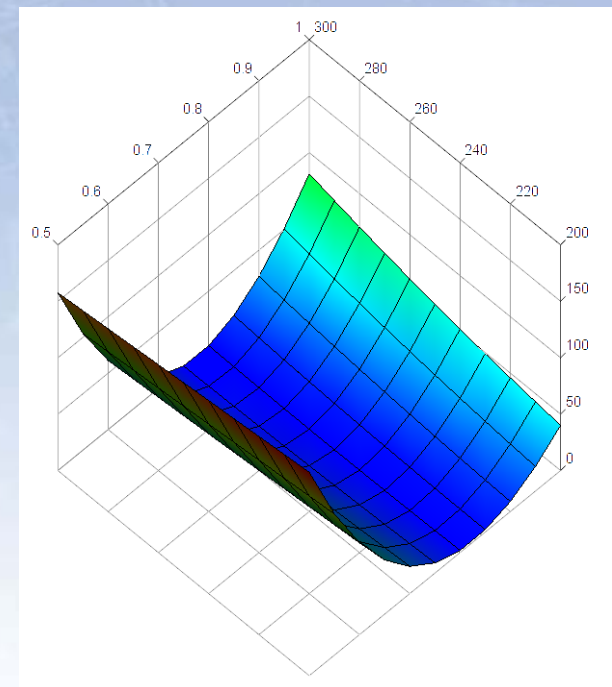
Nominal model: No losses, Efficiency = 1

Tuning
Efficiency: 0.80

Case 1 (used for Validation)

Case 1 (used for Calibration)

Similar operations with the same setup

- Calibration
- Validation
- Sensitivity analysis
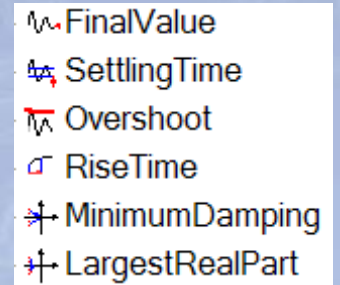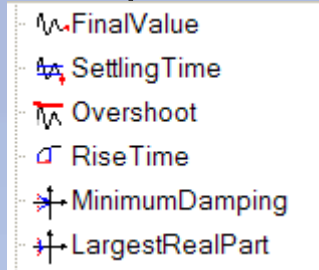- Parameter sweeping
- Checking calibration sensitivity

Design Optimization

Tune parameters of device or controller
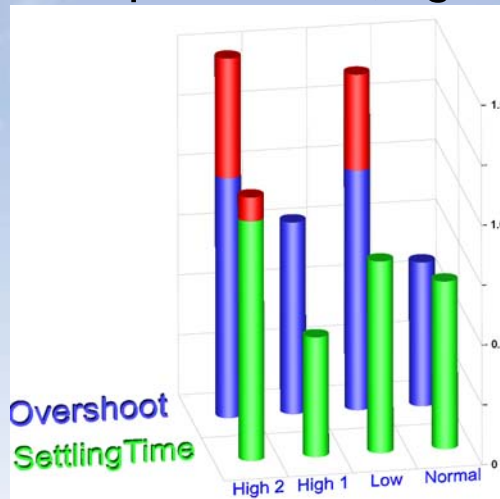to improve system dynamics
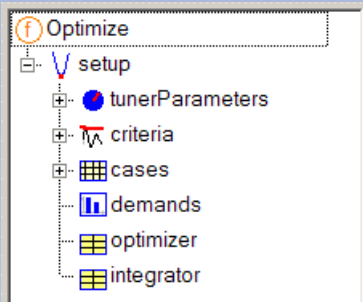
Criteria

- ## multiple criteria and constraints

  FinalValue
  SettlingTime
  Overshoot
  RiseTime
  MinimumDamping
  LargestRealPart

- ## multiple cases (e.g. different operating points)

Overshoot
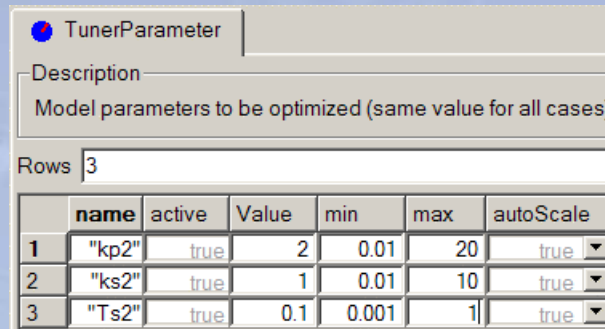SettlingTime

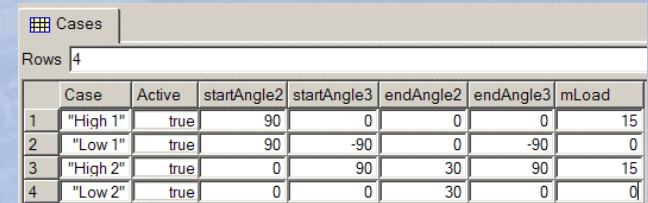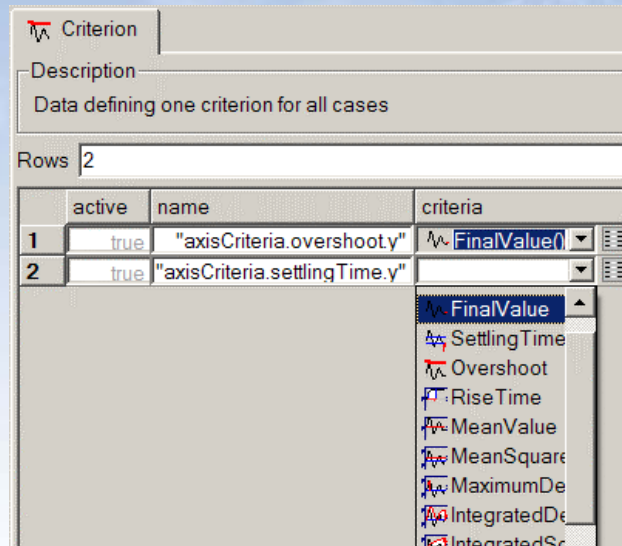High 2   High 1   Low   Normal

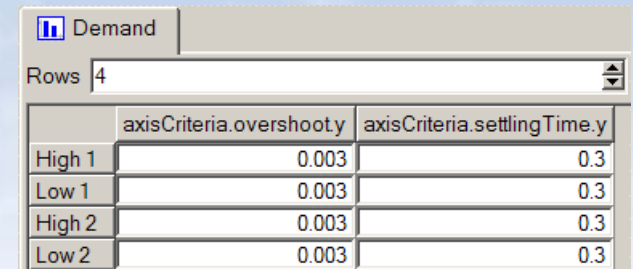- ## demand values to indicate trade-off

Setup Dialogs

Optimize
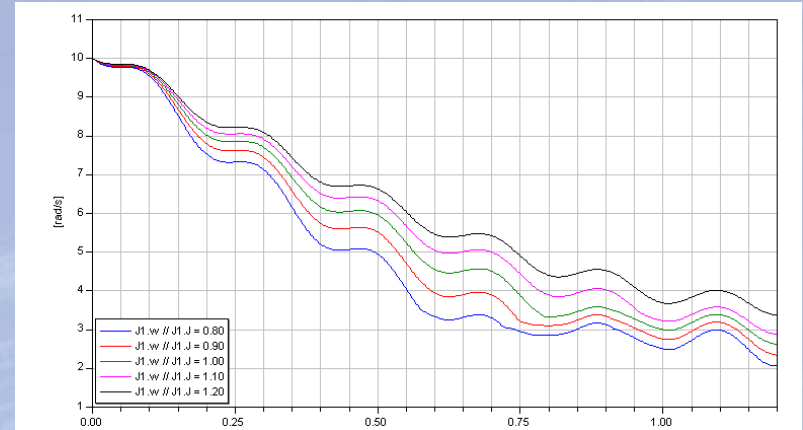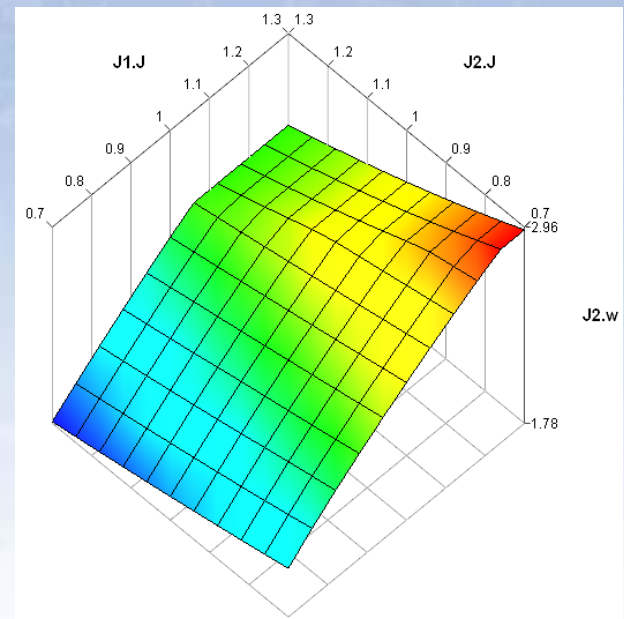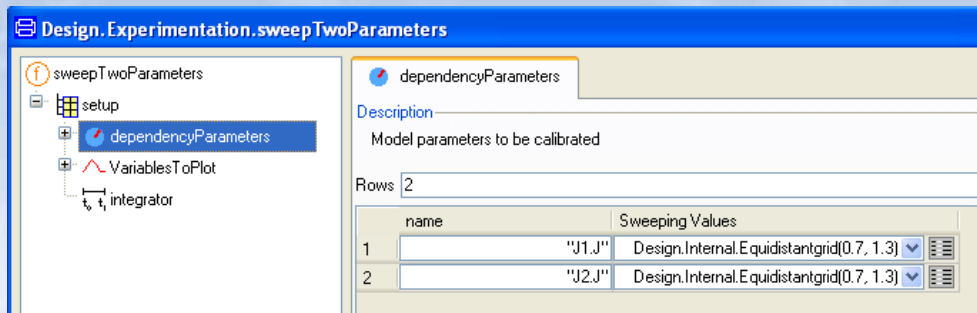

Tuners

Cases

Criteria

Demands

Model Experimentation

How sensitive to parameter variations is a model?

Parameter sweeping and perturbation

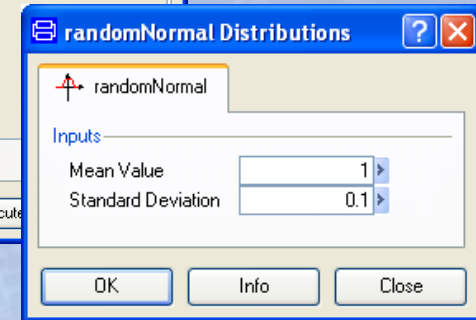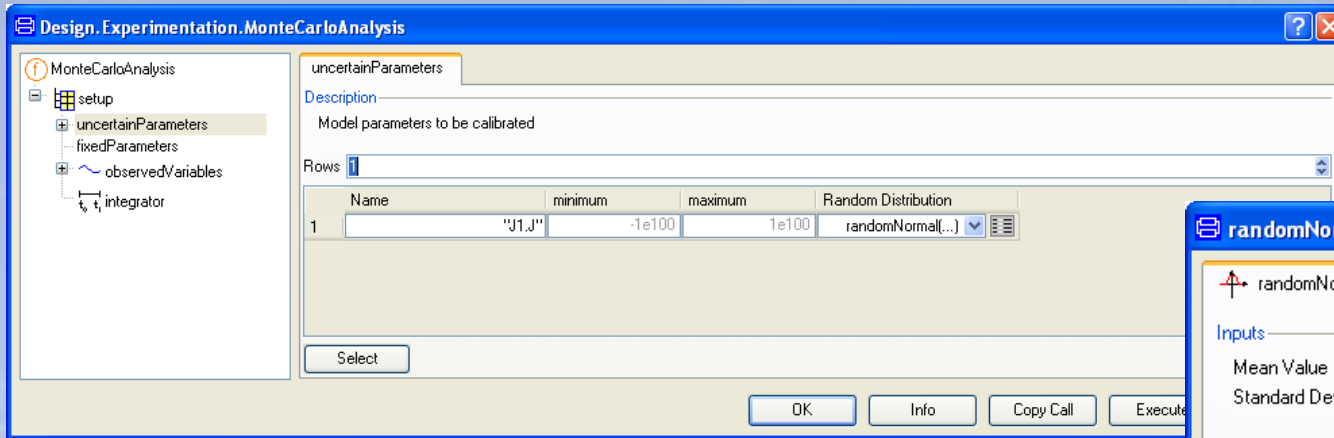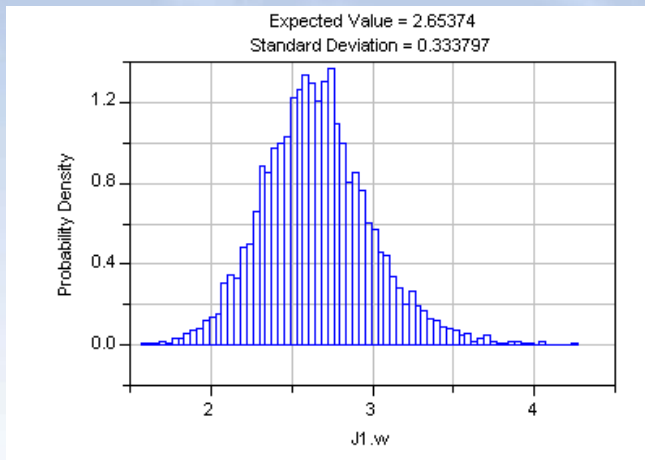**J1.w when varying J1.J from 0.8 to 1.2**

J2.w against J1.J and J2.J at t = 1.2

Monte Carlo Analysis

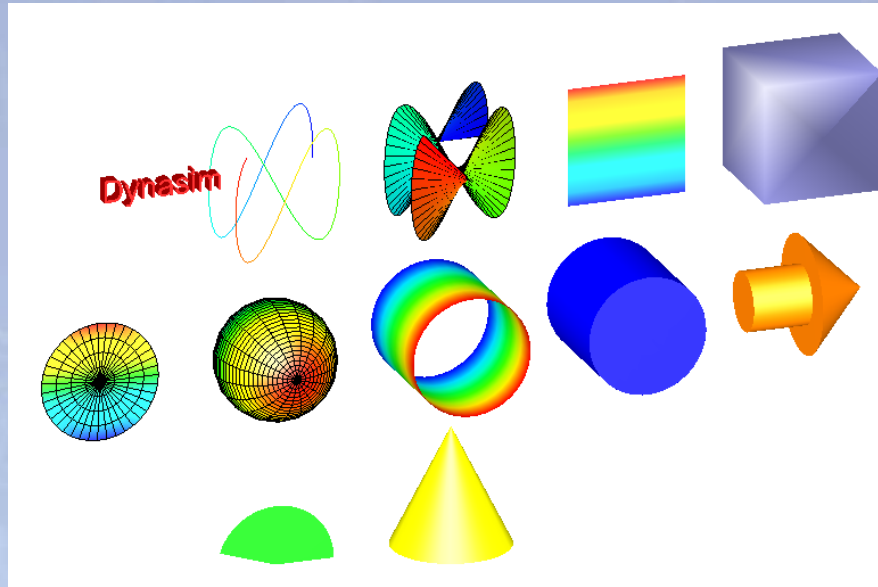Gaussian variation
of J1.J in Clutch model
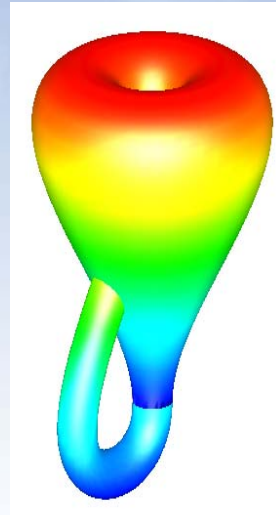
Random Distribution
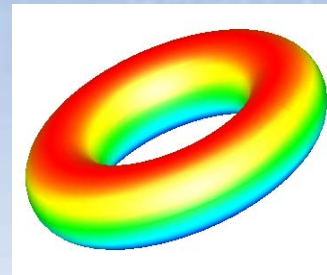Observed in variable

J4.w at time 1.2 s
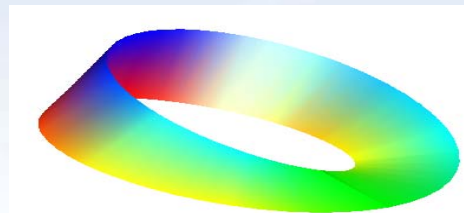
Visualize 3D
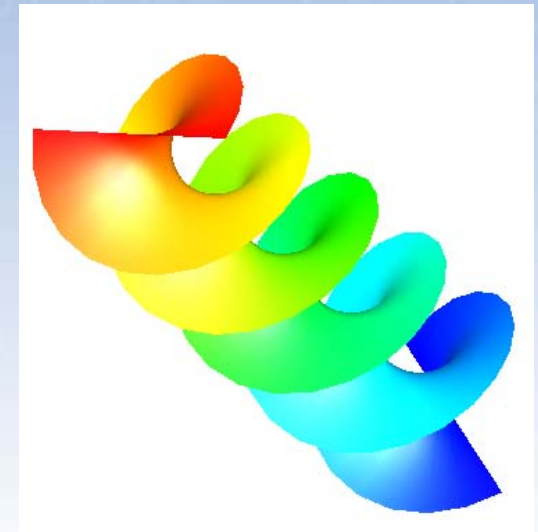
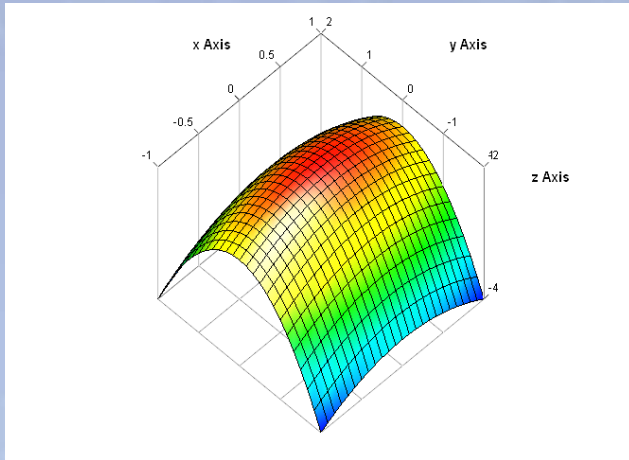Graphical Primitives
2D and 3D Text
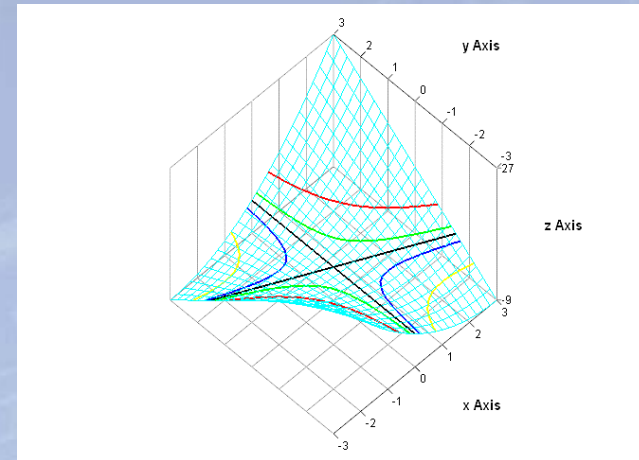
Parametric Surfaces

Klein Bottle

Torus

Moebius Band

Helix

Types of plots

Parametric Surfaces

Level Curves
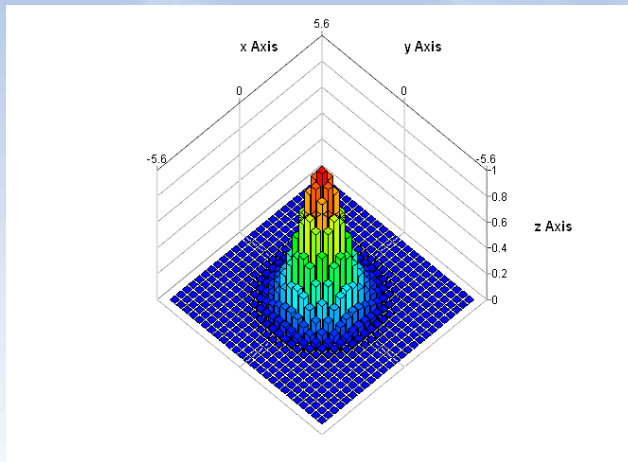
Bar Graphs
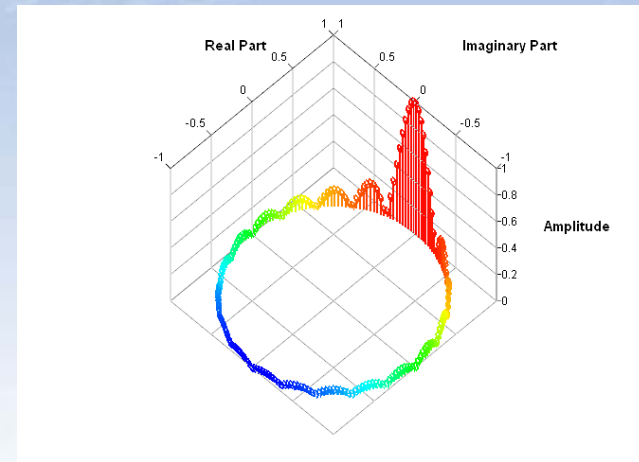
Stem Diagram

Customizable User Interfaces
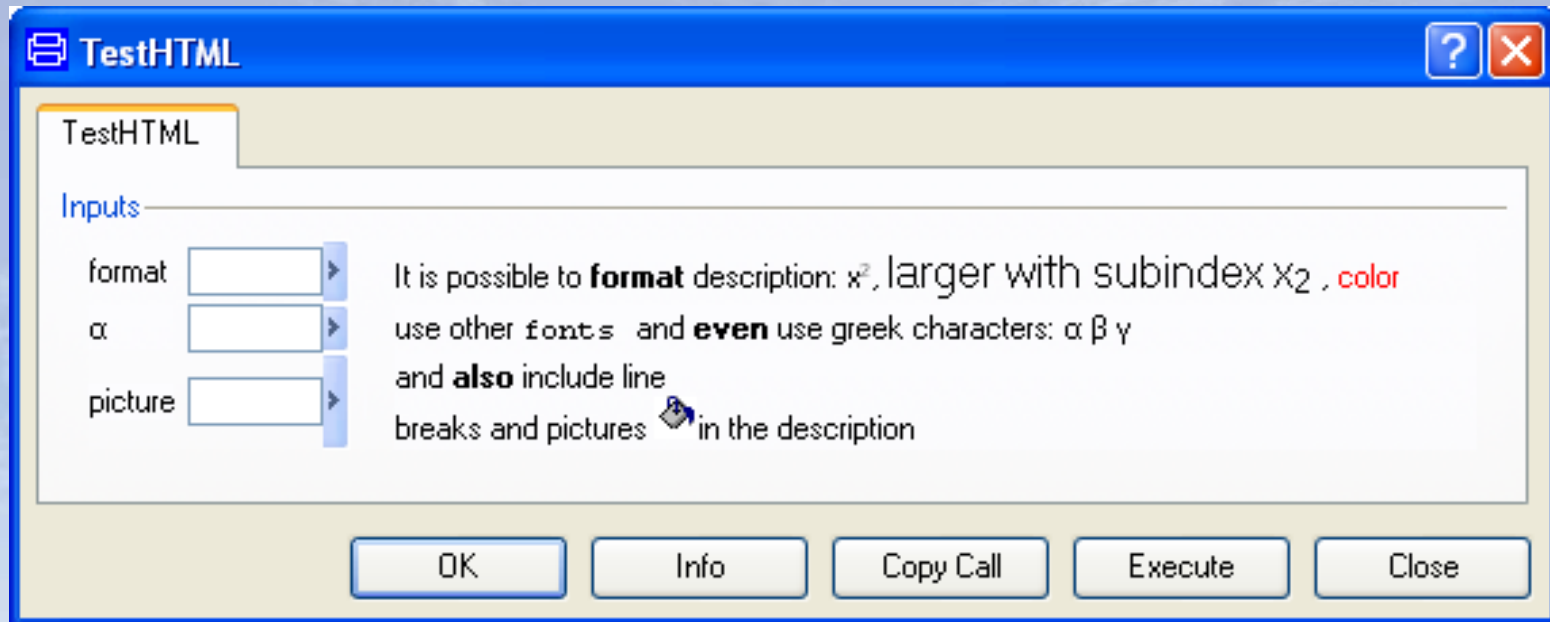
Flexible text formating in HTML

Flexible Layout
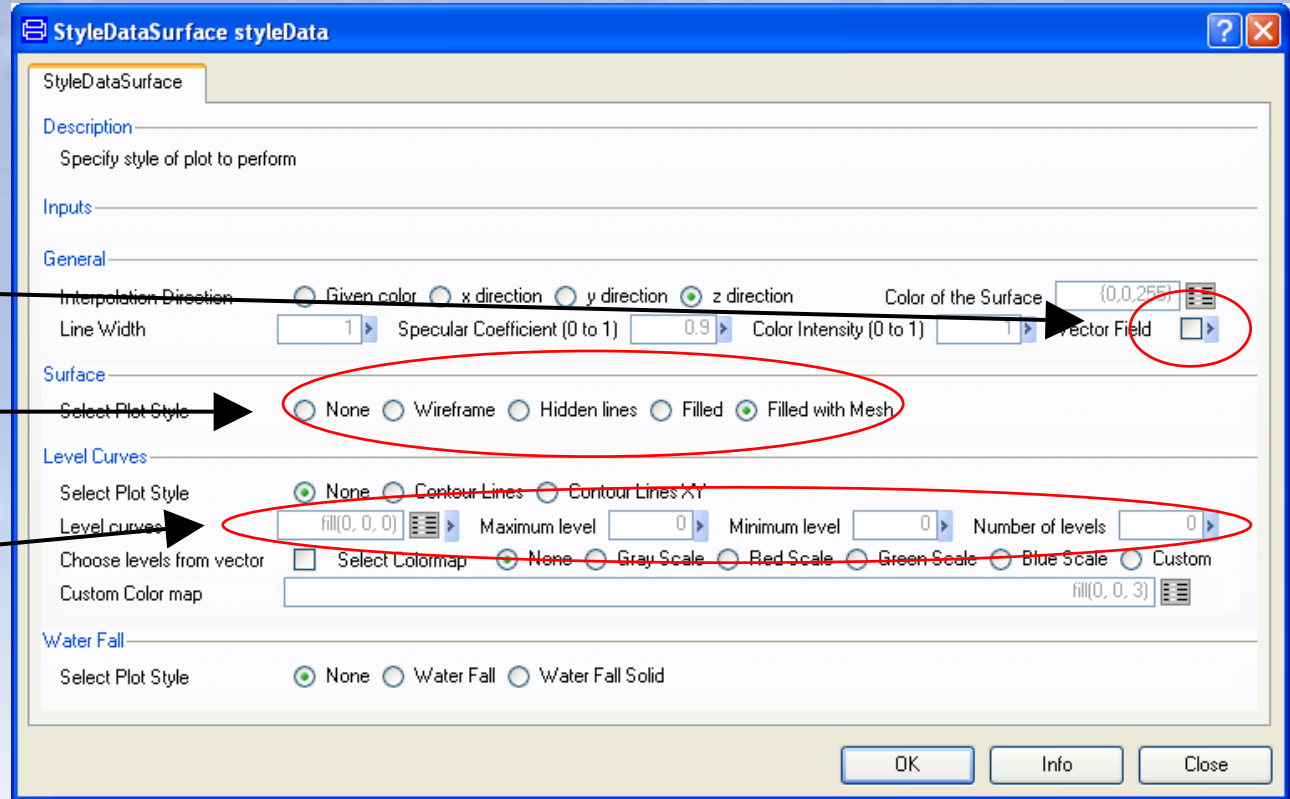
- Check Box

- Radio Buttons

- Vertical Layout

Nested Dialogs – Tree Browser
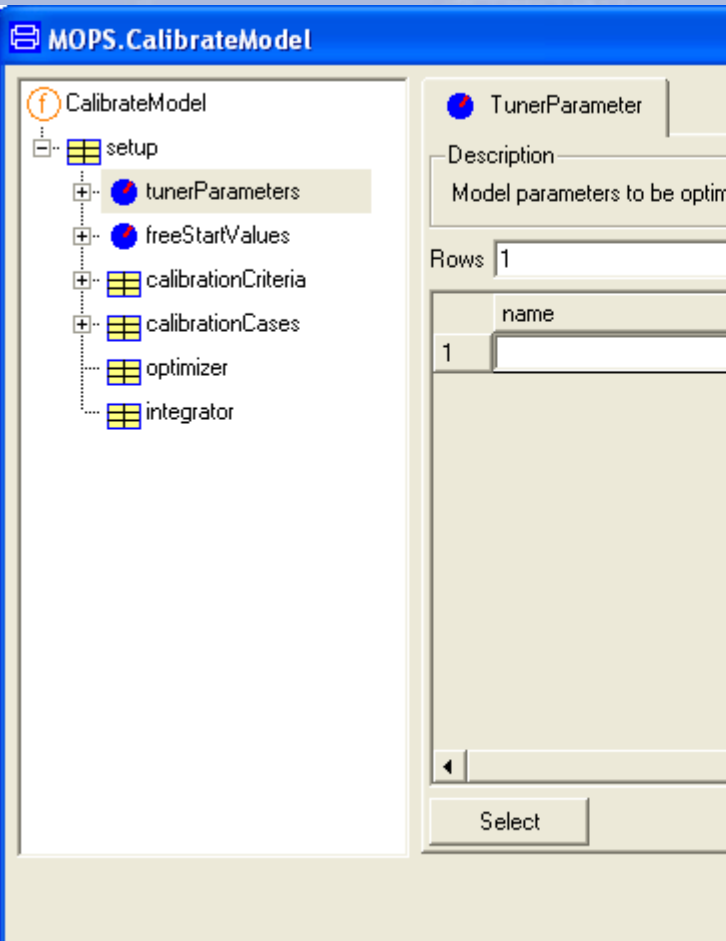

```
function CalibrateModel
  "Calibrate model to measured data"
  input ModelCalibrationSetup setup;
  ...
end CalibrateModel;
record ModelCalibrationSetup
  String Model;
  TunerParameter tunerParameters[:];
  ...
  Optimizer optimizer;
  Integrator integrator;
end ModelCalibrationSetup;
record TunerParameter
  "Model parameter to be optimized ..."
  String name="" "Full name of ...";
  Boolean active=true "true, if ...";
  ...
end TunerParameter;
```

Specialized Dialogs
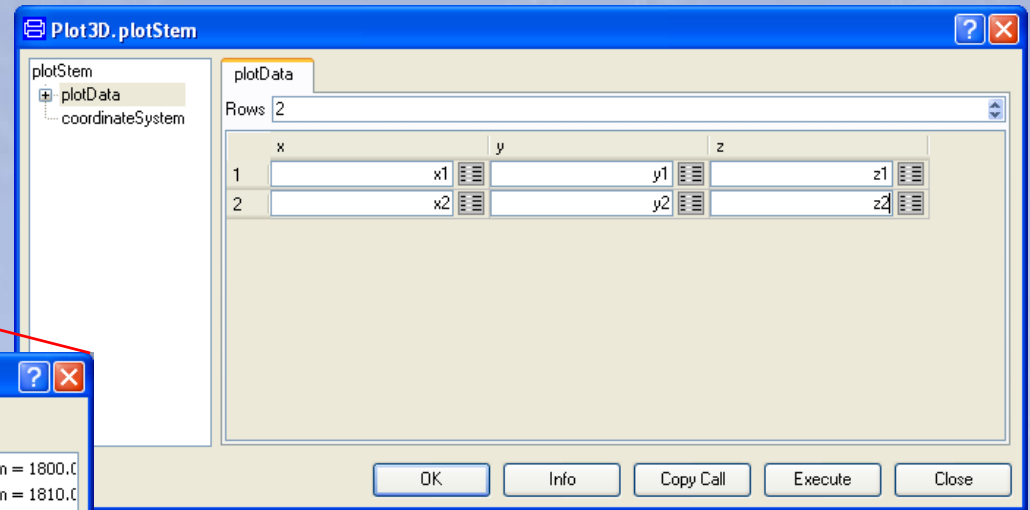
Array of records
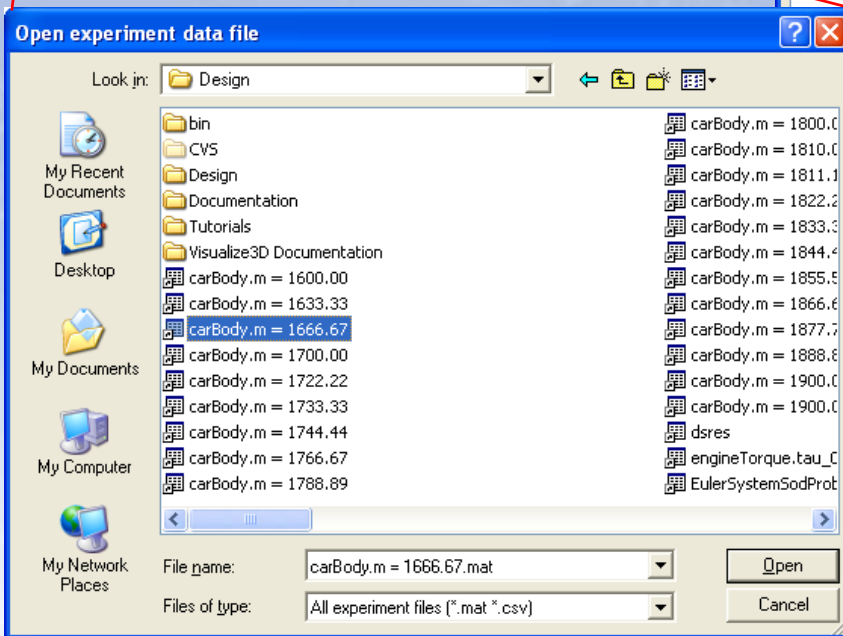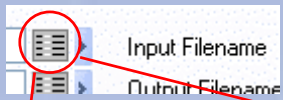
File Dialog
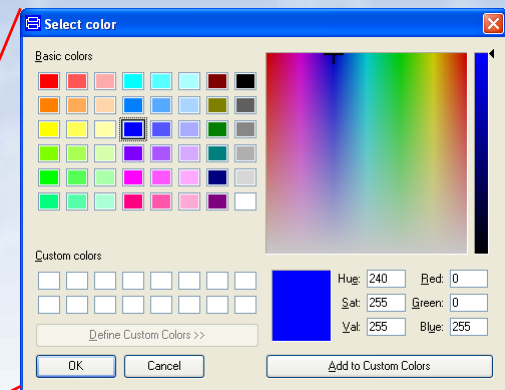
Color Dialog

Version Control

- Maintain revision history of model files
- Supports two common external tools
  - Concurrent Version System (CVS)
  - Subversion (SVN)
- Additional support in Dymola
  - Map from class name to file name
  - Reload files after "update" from repository

Encryption

- Protection of intellectual property
  - Distribute libraries with hidden parts
  - Allow parameterization with user models
  - Fine control of what is visible or concealed
- Encryption stores file in binary format
- Scrambling removes proprietary data and structure

Model Dependency

- Show how package depends on used classes
- Links in HTML documentation

These classes have been referenced in this package.

Class	Referenced From
Plot3D	sweepTwoParameters
Design.Internal.Records.MatCsvFileName	dataPreprocessing
Design.Internal.Records.MatCsvFileNameOut	dataPreprocessing
Design.Internal.Records.ModelCalibrationSetup	calibrate, checkCalibrationSensitivity, perturbParameters, sweepParameter, sweepTwoParameters
Design.Internal.Records.PerturbationParameter	perturbParameters
Design.Internal.Records.PreprocessingSignal	dataPreprocessing
Modelica.Utilities.Streams	dataPreprocessing
Modelica.Utilities.Streams.print	checkCalibrationSensitivity, sweepTwoParameters
Modelica.Utilities.Strings	checkCalibrationSensitivity, perturbParameters, sweepTwoParameters
Modelica_LinearSystems	dataPreprocessing