Model-Based Calibration Toolbox 3
Reference

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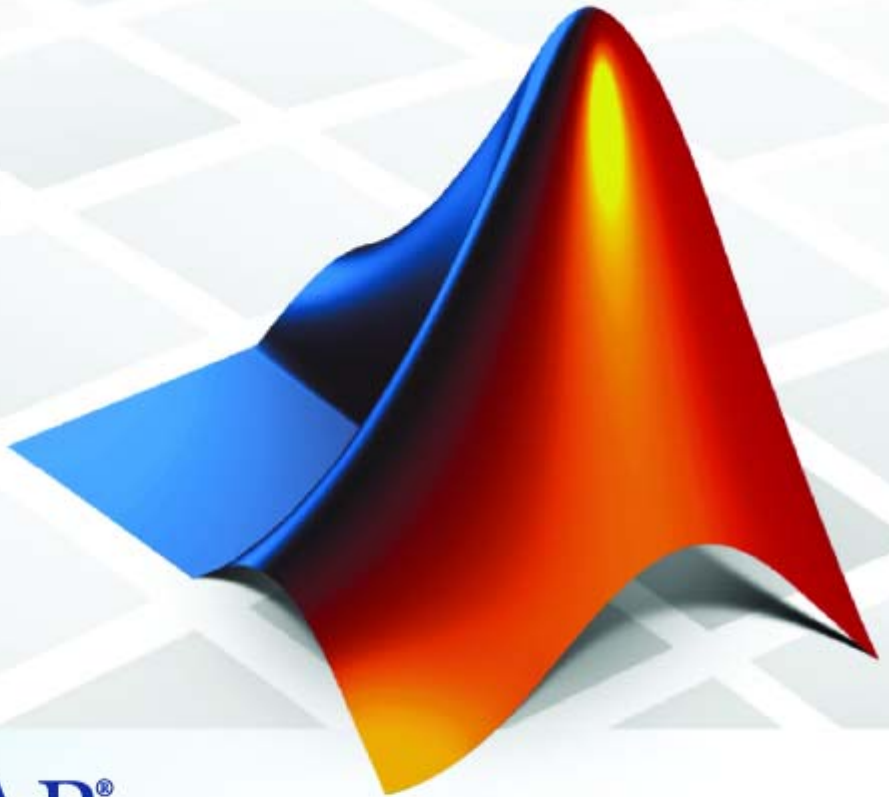
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Model-Based Calibration Toolbox Reference

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Commands – By Category

Functions

`CreateData`	Create data object
`CreateModel`	Create new model
`CreateProject`	Create project object
`DataFileTypes`	Data file types
`LoadProject`	Load mbcmodel.project
`modelinput`	Create modelinput object

Handling Data

mbcmodel.data — Properties

Filters	Structure array holding user-defined filters
IsBeingEdited	Boolean signaling if data or model is being edited
IsEditable	Boolean signaling whether data is editable
Name	Name of project, data, test plan, input, or model objects
NumberOfRecords	Total number of records in data object
NumberOfTests	Total number of tests being used in model
Owner	Object from which data was received
RecordsPerTest	Number of records in each test
SignalNames	Names of signals held by data
SignalUnits	Names of units in data
TestFilters	Structure array holding user-defined test filters
UserVariables	Structure array holding user-defined variables

mbcmodel.data — Methods

AddFilter	Add user-defined filter to data set
AddTestFilter	Add user-defined test filter to data set
AddVariable	Add user-defined variable to data set
Append	Append data to data set
BeginEdit	Begin editing session on data object
CommitEdit	Update temporary changes in data
DefineNumberOfRecordsPerTest	Define exact number of records per test
DefineTestGroups	Define rule-based test groupings
ExportToMBCDataStructure	Export data to MBC data structure
ImportFromFile	Load data from file
ImportFromMBCDataStructure	Load data from MBC data structure
ModifyFilter	Modify user-defined filter in data set
ModifyTestFilter	Modify user-defined test filter in data set
ModifyVariable	Modify user-defined variable in data set
RemoveFilter	Remove user-defined filter from data set
RemoveTestFilter	Remove user-defined test filter from data set
RemoveVariable	Remove user-defined variable from data set
RollbackEdit	Undo most recent changes to data
Value	Double data from data object

Handling Projects

mbcmodel.project — Properties

Data	Array of data objects in project or test plan
Filename	Full path to project file
Modified	Boolean signaling whether project has been modified
Name	Name of project, data, test plan, input, or model objects
TestPlans	Array of test plan objects in project

mbcmodel.project — Methods

CopyData	Create data object from copy of existing object
CreateData	Create data object
CreateTestplan	Create new test plan
Load	Load existing project file
New	Create new project file
Remove	Remove project, test plan, or model
RemoveData	Remove data from project
Save	Save project to currently selected filename
SaveAs	Save project to new file

Handling Test Plans

mbcmodel.testplan — Properties

`Data`	Array of data objects in project or test plan
`DefaultModels`	Inputs for test plan
`Inputs`	Inputs for test plan
`InputSignalNames`	Names of signals in data that are being modeled
`InputsPerLevel`	Number of inputs at each level in model
`Levels`	Number of levels in hierarchical model
`Name`	Name of project, data, test plan, input, or model objects
`Responses`	Array of available responses for test plan

mbcmodel.testplan — Methods

`AttachData`	Attach data from project to test plan
`CreateResponse`	Create new response model for test plan
`DetachData`	Detach data from test plan
`GetDesignMatrix`	Design points from test plan

`InputSetupDialog`	Open Input Setup dialog box to edit inputs
`Remove`	Remove project, test plan, or model

Handling Models

Hierarchical Models

mbcmodel.hierarchicalresponse — Properties

InputSignalNames	Names of signals in data that are being modeled
Level	Level in test plan of response
LocalResponses	Array of local responses for response
Name	Name of project, data, test plan, input, or model objects
NumberOfTests	Total number of tests being used in model
ResponseSignalName	Name of signal or response feature being modeled

mbcmodel.hierarchicalresponse — Methods

AlternativeModelStatistics	Summary statistics for alternative models
CreateAlternativeModels	Create alternative models from model template
DoubleInputData	Data being used as input to model

DoubleResponseData	Data being used as output to model for fitting
Export	Make command-line or Simulink® export model
OutlierIndices	Indices of DoubleInputData marked as outliers
PEV	Predicted error variance of model at specified inputs
PredictedValue	Predicted value of model at specified inputs
Remove	Remove project, test plan, or model
SummaryStatistics	Summary statistics for response

Local Models

mbcmodel.localresponse — Properties

InputSignalNames	Names of signals in data that are being modeled
Level	Level in test plan of response
Name	Name of project, data, test plan, input, or model objects
NumberOfTests	Total number of tests being used in model
ResponseFeatures(Local Response)	Array of response features for local response
ResponseSignalName	Name of signal or response feature being modeled

mbcmodel.localresponse — Methods

`AlternativeModelStatistics`	Summary statistics for alternative models
`CreateAlternativeModels`	Create alternative models from model template
`CreateResponseFeature`	Create new response feature for local model
`DiagnosticStatistics`	Diagnostic statistics for response
`DoubleInputData`	Data being used as input to model
`DoubleResponseData`	Data being used as output to model for fitting
`Export`	Make command-line or Simulink® export model
`MakeHierarchicalResponse`	Build two-stage model from response feature models
`ModelForTest`	Model for specified test
`OutlierIndices`	Indices of `DoubleInputData` marked as outliers
`OutlierIndicesForTest`	Indices marked as outliers for test
`PEV`	Predicted error variance of model at specified inputs
`PEVForTest`	Local model predicted error variance for test
`PredictedValue`	Predicted value of model at specified inputs
`PredictedValueForTest`	Predicted local model response for test
`Remove`	Remove project, test plan, or model
`RemoveOutliers`	Remove outliers in input data by index or rule, and refit models

RemoveOutliersForTest	Remove outliers on test by index or rule and refit models
RestoreData	Restore removed outliers
RestoreDataForTest	Restore removed outliers for test
SummaryStatistics	Summary statistics for response
SummaryStatisticsForTest	Statistics for specified test
UpdateResponseFeatures	Refit response feature models

mbcmodel.localmodel — Properties

LocalModel Properties	Edit local model properties
ResponseFeatures(Local Model)	Set of response features for local model

Response Models

mbcmodel.response — Properties

AlternativeResponses	Array of alternative responses for this response
InputSignalNames	Names of signals in data that are being modeled
Level	Level in test plan of response
Model	Model object within response object
Name	Name of project, data, test plan, input, or model objects
NumberOfTests	Total number of tests being used in model
ResponseSignalName	Name of signal or response feature being modeled

mbcmodel.response — Methods

`AlternativeModelStatistics`	Summary statistics for alternative models
`ChooseAsBest`	Choose best model from alternative responses
`CreateAlternativeModels`	Create alternative models from model template
`DiagnosticStatistics`	Diagnostic statistics for response
`DoubleInputData`	Data being used as input to model
`DoubleResponseData`	Data being used as output to model for fitting
`Export`	Make command-line or Simulink® export model
`OutlierIndices`	Indices of `DoubleInputData` marked as outliers
`PEV`	Predicted error variance of model at specified inputs
`PredictedValue`	Predicted value of model at specified inputs
`Remove`	Remove project, test plan, or model
`RemoveOutliers`	Remove outliers in input data by index or rule, and refit models
`RestoreData`	Restore removed outliers
`SummaryStatistics`	Summary statistics for response

Models

Response objects contain an `mbcmodel.model` object with the following properties and methods.

mbcmodel.model — Properties

FitAlgorithm	Fit algorithm for model
InputData	Input data for model
Inputs	Inputs for test plan
IsBeingEdited	Boolean signaling if data or model is being edited
NumberOfInputs	Number of model inputs
OutputData	Output (or response) data for model
Parameters	Model parameters
Properties	View and edit model properties
Response	Response for model object
Status	Model status: fitted, not fitted or best
Type	Valid model types
Units	Model output units
XData	X (or input) data for model
XDataNames	X data (or input) variable names for model
YData	Y (or response) data for model

mbcmodel.linearmodel — Linear Model Methods

AliasMatrix	Alias matrix for linear model parameters
BoxCoxSSE	SSE and confidence interval for Box-Cox transformations
Correlation	Correlation matrix for linear model parameters
Covariance	Covariance matrix for linear model parameters

MultipleVIF	Multiple VIF matrix for linear model parameters
ParameterStatistics	Calculate parameter statistics for linear model
PartialVIF	Partial VIF matrix for linear model parameters
SingleVIF	Single VIF matrix for linear model parameters
StepwiseRegression	Change stepwise selection status for specified terms

mbcmodel.model — Methods

Evaluate	Evaluate model
Export	Make command-line or Simulink® export model
Fit	Fit model to new or existing data, and provide summary statistics
getAlternativeTypes	Alternative model types
InputSetupDialog	Open Input Setup dialog box to edit inputs
Jacobian	Calculate Jacobian matrix for model at existing or new X points
ModelSetup	Open Model Setup dialog box where you can alter model type
PEV	Predicted error variance of model at specified inputs
PredictedValue	Predicted value of model at specified inputs
StatisticsDialog	Open summary statistics dialog box

SummaryStatistics	Summary statistics for response
UpdateResponse	Replace model in response

mbcmodel.fitalgorithm — Methods

An `mbcmodel.fitalgorithm` object is contained within the `Properties` property of an `mbcmodel.model` object.

CreateAlgorithm	Create algorithm
getAlternativeNames	List alternative algorithm names
IsAlternative	Test alternative fit algorithm
SetupDialog	Open fit algorithm setup dialog box

Model Parameters

These properties of the `mbcmodel.modelparameters` object are all read-only. An `mbcmodel.modelparameters` object is contained within the `Parameters` property of an `mbcmodel.model` object.

mbcmodel.modelparameters — Properties

Names	Model parameter names
NumberOfParameters	Number of included model parameters
Values	Values of model parameters

mbcmodel.linearmodelparameters — Linear Model Properties

A mbcmodel.linearmodelparameters object is a mbcmodel.modelparameters object plus the following properties.

SizeOfParameterSet	Number of model parameters
StepwiseSelection	Model parameters currently included and excluded
StepwiseStatus	Stepwise status of parameters in model

mbcmodel.rbfmodelparameters — RBF Model Properties

A mbcmodel.rbfmodelparameters object is a mbcmodel.linearmodelparameters object plus the following properties.

Centers	Centers of RBF model
Widths	Width data from RBF model

Model Properties

mbcmodel.linearmodelproperties — Methods

GetAllTerms	List all model terms
GetIncludedTerms	List included model terms
SetTermStatus	Set status of model terms

Commands — Alphabetical List

AddFilter

Purpose	Add user-defined filter to data set
Syntax	`D = AddFilter(D, expr)`
Description	This is a method of `mbcmodel.data`.

A filter is a constraint on the data set used to exclude some records. You define the filter using logical operators or a logical function on the existing variables.

`D` is the `mbcmodel.data` object you want to filter.

`expr` is an input string holding the expression that defines the filter.

Examples

```
AddFilter(D, 'AFR < AFR_CALC + 10');
```

The effect of this filter is to keep all records where AFR < AFR_CALC +10.

```
AddFilter(D, 'MyFilterFunction(AFR, RPM, TQ, SPK)');
```

The effect of this filter is to apply the function `MyFilterFunction` using the variables AFR, RPM, TQ, SPK.

All filter functions receive an nx1 vector for each variable and must return an nx1 logical array out. In that array, true (or `1`) indicates a record to keep, and false (or `0`) indicates a record to discard.

See Also

`ModifyFilter, RemoveFilter, Filters, AddTestFilter, ModifyTestFilter`

Purpose   Add user-defined test filter to data set

Syntax   D = AddTestFilter(D, expr)

Description   This is a method of mbcmodel.data.

A test filter is a constraint on the data set used to exclude some entire tests. You define the test filter using logical operators or functions on the existing variables.

D is your data object

expr is the input string holding the definition of the new test filter.

Examples   AddTestFilter(d1, 'any(n>1000)');

The effect of this filter is to include all tests in which all records have speed (n) greater than 1000.

Similar to filters, test filter functions are iteratively evaluated on each test, receiving an nx1 vector for each variable input in a test, and must return an 1x1 logical array out. In that array, true (or 1) indicates a record to keep, and false (or 0) indicates a test to discard.

    AddTestFilter(data, 'length(LOGNO) > 6');

The effect of this filter is to include all tests with more than 6 records.

See Also   ModifyTestFilter, RemoveTestFilter, TestFilters, AddFilter

AddVariable

Purpose	Add user-defined variable to data set
Syntax	`D = AddVariable(D, expr, units)`
Description	This is a method of `mbcmodel.data`.
	You can define new variables in terms of existing variables. Note that variable names are case sensitive.
	`D` is your data object
	`expr` is the input string holding the definition of the new variable
	`units` is an optional input string holding the units of the variable
| **Examples** | ```
AddVariable(D, 'MY_NEW_VARIABLE = TQ*AFR/2');
AddVariable(D, 'funcVar = MyVariableFunction(TQ, AFR, RPM)',
'lb');
AddVariable(D, 'TQ=tq');
``` |
| | The last example could be useful if the signal names in the data do not match the model input factor names in the test plan template file. |
| **See Also** | `ModifyVariable`, `RemoveVariable`, `UserVariables` |

Purpose   Alias matrix for linear model parameters

Syntax   `A = M.AliasMatrix`

Description   This is a method of `mbcmodel.linearmodel`.

A = M.AliasMatrix calculates the alias matrix for the linear model parameters (where M is a linear model).

Examples   `A = AliasMatrix(knot_model)`

See Also   `ParameterStatistics`

AlternativeModelStatistics

Purpose	Summary statistics for alternative models
Syntax	S = AlternativeModelStatistics(R) S = AlternativeModelStatistics(R, Name)
Description	This is a method of all model objects: `mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse` and `mbcmodel.response`.

This returns an array (`S`) of summary statistics of all the alternative model fits, to be used to select the best model. These are the summary statistics seen in the list view at the bottom of the Model Browser GUI in any model view.

You must use CreateAlternativeModels before you can compare the alternative responses using AlternativeModelStatistics. Then use ChooseAsBest.

`R` is the model object whose alternative response models you want to compare. `R` could be a local (`L`), response feature (`R`) or hierarchical response (`HR`) model.

`S` is a structure containing `Statistics` and `Names` fields.

- `S.Statistics` is a matrix of size (number alternative responses x number of statistics)

- `S.Names` is a cell array containing the names of all the statistics

The available statistics vary according to what kind of parent model (two-stage, local, response feature or response) produced the alternative models, and include PRESS RMSE, RMSE, and Two-Stage RMSE.

All the available statistics are calculated unless you specify which you want. You can specify only the statistics you require using the following form:

```
S = AlternativeModelStatistics(R, Name)
```

This returns a double matrix containing only the statistics specified in `Name`.

Note that you use SummaryStatistics to examine the fit of the current model, and AlternativeModelStatistics to examine the fit of several alternative child models.

Examples   S = AlternativeModelStatistics(R);

See Also   CreateAlternativeModels, SummaryStatistics, ChooseAsBest

AlternativeResponses

Purpose	Array of alternative responses for this response
Syntax	altR = R.AlternativeResponses
Description	This is a property of the response model object, mbcmodel.response (R).
	It returns a list of alternative responses used for one-stage or response feature models.
Examples	R = testplan.Responses; TQ = R(1); AR = TQ.AlternativeResponses;
See Also	LocalResponses, ResponseFeatures(Local Response)

Purpose   Append data to data set

Syntax   `D = Append(D, otherData)`

Description This is a method of `mbcmodel.data`.

You can use this to add new data to your existing data set, D.

`otherData` is the input argument holding the extra data to add below the existing data. This argument can either be an `mbcmodel.data` object or a double array. The behavior is different depending on the type.

If `otherData` is an `mbcmodel.data` object then Append will look for common `SignalNames` between the two sets of data. If no common `SignalNames` are found then a error will be thrown. Any common signals will be Appended to the existing data and other signals will be filled with `NaN`.

If `otherData` is a double array then it must have exactly the same number of columns as there are `SignalNames` in the data, and a simple `vertcat` (vertical concatenation) is applied between the existing data and `otherData`.

Examples
```
Append(D, CreateData('aDataFile.xls'));
Append(D, rand(10,100));
```

See Also   `CreateData`

AttachData

Purpose	Attach data from project to test plan
Syntax	newD = AttachData(T, D, Property1, Value, Property2, Value...)
Description	This is a method of mbcmodel.testplan. Use it to attach the data you want to model to the test plan.

T is the test plan object, D is the data object.

The following table shows the valid properties and their corresponding possible values. These are the settings shown in the last page of the Data Wizard (if there is a design) in the Model Browser. For more information on the meaning of these settings, refer to the Data Wizard section (under Data) in the *Model Browser User's Guide*.

> **Note** If the testplan has responses set up the models are fitted when you attach data.

Property	Value	Default
unmatcheddata	{'all', 'none'}	'all'
moredata	{'all', 'closest'}	'all'
moredesign	{'none', 'closest'}	'none'
tolerances	[1xNumInputs double]	ModelRange/20

When you attach data to a test plan the Name property of the test plan inputs is used to select data channels. If the Name is empty then the Symbol is used as the Name. If the Name does not exist in the data set, an error is generated.

When a test plan has data attached, it is only possible to change the symbols, ranges or nonlinear transforms of the test plan inputs.

Examples

```
newD = AttachData(T1, D1, `more data', `all');

tol = [0.075, 100, 1, 2];
unmatch = 'all';
moredata = 'all';
moredes = 'none';
AttachData(testplan, data ,...
    'tolerances',    tol,...
    'unmatcheddata', unmatch,...
    'moredata',      moredata,...
    'moredesign',    moredes);
```

See Also   Data, DetachData

BeginEdit

Purpose	Begin editing session on data object
Syntax	`D = BeginEdit(D)`
Description	This is a method of `mbcmodel.data`.
	You must call this method before you can make any changes to a data object.
	There are no input arguments. You must call `BeginEdit` before attempting to modify your data object (`D` in the example below) in any way. An error will be thrown if this condition is not satisfied. Data which cannot be edited (see `IsEditable`) will throw an error if `BeginEdit` is called.
Examples	`BeginEdit(D);`
See Also	`CommitEdit`, `RollbackEdit`, `IsEditable`, `IsBeingEdited`

Purpose   SSE and confidence interval for Box-Cox transformations

Syntax   ```
[sse, ci, lambda] = BoxCoxSSE(Model, lambda)
[sse, ci, lambda] = BoxCoxSSE(Model)
BoxCoxSSE(Model, ...)
```

Description   This is a method of mbcmodel.linearmodel.

[sse, ci, lambda] = BoxCoxSSE(Model, lambda) computes the sum of squares error (sse) and confidence interval (ci) for values of the model under different Box-Cox transforms (as given by the parameter lambda). The data used is that which was used to fit the model. sse is a vector the same size as lambda and ci is a scalar. There is no statistical difference between the Box-Cox transforms where sse less than ci.

[sse, ci, lambda] = BoxCoxSSE(Model) If lambda is not specified, then default values for are used and these are returned in third output argument.

BoxCoxSSE(Model, ...) If no output arguments are requested then a plot of SSE versus lambda is displayed. The confidence intervals are also displayed on this plot.

Examples   To try several different values, of the Box-Cox parameter and plot the results:

```
lambda = -3:0.5:3;
[sse, ci] = BoxCoxSSE( M, lambda);
semilogy( lambda, sse, 'bo-', lambda([1,end]), [ci, ci], 'r--' );
xlabel( 'Box-Cox parameter, \lambda' );
ylabel( 'SSE' );
```

Note that BoxCoxSSE does not set a Box-Cox transform in the model. To do this use:

```
M.Properties.BoxCox = O;
[S,M] = M.Fit;
```

See Also   ParameterStatistics

Centers

Purpose   Centers of RBF model

Syntax   centers = params.Centers

Description This is a property of `mbcmodel.rbfmodelparameters`, for Radial
                 Basis Function (RBF) models only. This returns an array of size
                 number_of_centers by number_of_variables.

Examples   centers = params.Centers;

See Also   Widths

Purpose   Choose best model from alternative responses

Syntax   ChooseAsBest(R, Index)

Description   This is a method of the response model object, mbcmodel.response.
                  This is the same function as selecting the best model in the Model
                  Selection window of the Model Browser GUI. For a local model
                  MakeHierarchicalResponse performs a similar function.

                  R is the object containing the response model

                  Index is the number of the response model you want to choose as best.
                  Use AlternativeResponses to find the index for each response model,
                  and use AlternativeModelStatistics to choose the best fit.

Examples   ```
                  ChooseAsBest(R, AlternativeModel)
                  RMSE = AlternativeModelStatistics(R, 'RMSE');
                  [mr, Best] = min(RMSE);
                  ChooseAsBest(R, Best);
                  ```

**See Also**      AlternativeResponses, AlternativeModelStatistics,
                  DiagnosticStatistics, MakeHierarchicalResponse

# CommitEdit

| | |
|---|---|
| **Purpose** | Update temporary changes in data |
| **Syntax** | `D = CommitEdit(D)` |
| **Description** | This is a method of `mbcmodel.data`. |

Use this to apply changes you have made to the data, such as creating new variables and applying filters to remove unwanted records.

There are no input arguments. Once you have finished editing your data object `D` you must commit your changes back to the project. Data can only be committed if both `IsEditable` and `IsBeingEdited` are true. `CommitEdit` will throw an error if these conditions are not met.

**Examples**

```
D = P.Data;
BeginEdit(D);
AddVariable(D, 'TQ = tq', 'lbft');
AddFilter(D, 'TQ < 200');
DefineTestGroups(D, {'RPM' 'AFR'}, [50 10], 'MyLogNo');
CommitEdit(D);
```

For an example situation which results in `CommitEdit` failing:

```
D  = p.Data;
D1 = p.Data;
BeginEdit(D1);
tp = p.'Testplan;
Attach(tp, D);
```

Where `p` is an `mbcmodel.project` object, and `D` and `D1` are `mbcmodel.data` objects.

At this point `IsEditable(D1)` becomes false because it is now `Attached` to the test plan and hence can only be modified from the test plan. If you now enter:

```
OK = D1.IsEditable
```

the answer is `false`.

If you now enter:

```
CommitEdit(D1);
```

An error is thrown because the data is no longer editable. The error message informs you that the data may have been attached to a test plan and can only be edited from there.

See Also   BeginEdit, RollbackEdit, IsEditable, IsBeingEdited

CopyData

Purpose	Create data object from copy of existing object
Syntax	`newD = CopyData(P, D)` `newD = CopyData(P, Index)`
Description	This is a method of `mbcmodel.project`. Use this to duplicate data, for example if you want to make changes for further modeling but want to retain the existing data set. You can refer to the data object either by name or index. `P` is the project object. `D` is the data object you want to copy. `Index` is the index of the data object you want to copy.
Examples	`D2 = CopyData(P1, D1);`
See Also	`Data`, `CreateData`, `RemoveData`

Purpose   Correlation matrix for linear model parameters

Syntax   `STATS = Correlation(LINEARMODEL)`

Description This is a method of `mbcmodel.linearmodel`.

       `STATS = Correlation(LINEARMODEL)` calculates the correlation matrix for the linear model parameters.

Examples   `Stats = Correlation(knot_model)`

See Also   `ParameterStatistics`

Covariance

Purpose	Covariance matrix for linear model parameters
Syntax	STATS = Covariance(LINEARMODEL)
Description	This is a method of mbcmodel.linearmodel.
	STATS = Covariance(LINEARMODEL) calculates the covariance matrix for the linear model parameters.
Examples	Stats = Covariance(knot_model)
See Also	ParameterStatistics

Purpose   Create algorithm

Syntax   newalg = alg.CreateAlgorithm(AlgorithmName)

Description   This is a method of mbcmodel.fitalgorithm.

newalg = alg.CreateAlgorithm(AlgorithmName) creates an
algorithm of the specified type. alg is a mbcmodel.fitalgorithm object.
AlgorithmName must be in the list of alternative algorithms given by
alg.getAlternativeNames.

To change the fit algorithm for a model:

```
>> mdl = mbcmodel.CreateModel('Polynomial', 2);
>> minpress = mdl.FitAlgorithm.CreateAlgorithm('Minimize PRESS');
>> mdl.FitAlgorithm = minpress;
```

The AlgorithmName determines what properties you can set. You can
display the properties for an algorithm as follows:

```
>> mdl.FitAlgorithm.properties

Algorithm: Minimize PRESS
Alternatives: 'Least Squares','Forward Selection','Backward
Selection','Prune'
     MaxIter: Maximum Iterations (int: [1,1000])
```

The following sections list the properties available for each algorithm
type.

**Linear
Model
Algorithm
Properties**

Linear Models Algorithms

Used by polynomials, hybrid splines and as the StepAlgorithm for RBF
algorithms.

Algorithm: Least Squares

Alternatives: 'Minimize PRESS','Forward Selection','Backward
Selection','Prune'

CreateAlgorithm

Algorithm: Minimize PRESS

Alternatives: `'Least Squares','Forward Selection','Backward Selection','Prune'`

- MaxIter: Maximum Iterations (int: [1,1000])

Algorithm: Forward Selection

Alternatives: `'Least Squares','Minimize PRESS','Backward Selection','Prune'`

- ConfidenceLevel: Confidence level (%) (numeric: [70,100])
- MaxIter: Maximum Iterations (int: [1,1000])
- RemoveAll: Remove all terms first (Boolean)

Algorithm: Backward Selection

Alternatives: `'Least Squares','Minimize PRESS','Forward Selection','Prune'`

- ConfidenceLevel: Alpha (%) (numeric: [70,100])
- MaxIter: Maximum Iterations (int: [1,1000])
- IncludeAll: Include all terms first (Boolean)

Algorithm: Prune

Alternatives: `'Least Squares','Minimize PRESS','Forward Selection','Backward Selection'`

- Criteria (PRESS RMSE|RMSE|GCV|Weighted PRESS|-2logL|AIC|AICc|BIC|R^2|R^2 adj|PRESS R^2|DW|Cp|cond(J))
- MinTerms: Minimum number of terms (int: [0,Inf])
- Tolerance (numeric: [0,1000])

- IncludeAll: Include all terms before prune (Boolean)

- Display (Boolean)

RBF Algorithm Properties

For information about any of the RBF and Hybrid RBF algorithm properties, see "Radial Basis Functions", and especially "Fitting Routines" in the Model Browser User's Guide.

Algorithm: RBF Fit

- WidthAlgorithm: Width selection algorithm (mbcmodel.fitalgorithm)

- StepAlgorithm: Stepwise (mbcmodel.fitalgorithm)

Width Selection Algorithms

Alternatives: `'WidPerDim','Tree Regression'`

Algorithm: TrialWidths

- NestedFitAlgorithm: Lambda selection algorithm (mbcmodel.fitalgorithm)

- Trials: Number of trial widths in each zoom (int: [2,100])

- Zooms: Number of zooms (int: [1,100])

- MinWidth: Initial lower bound on width (numeric: [2.22045e-016,1000])

- MaxWidth: Initial upper bound on width (numeric: [2.22045e-016,100])

- PlotFlag: Display plots (Boolean)

- PlotProgress: Display fit progress (Boolean)

Algorithm: WidPerDim

Alternatives: `'TrialWidths','Tree Regression'`

- NestedFitAlgorithm: Lambda selection algorithm (mbcmodel.fitalgorithm)

- DisplayFlag: Display (Boolean)

- MaxFunEvals: Maximum number of test widths (int: [1,1e+006])

- PlotProgress: Display fit progress (Boolean)

Algorithm: Tree Regression

Alternatives: `'TrialWidths','WidPerDim'`

- MaxNumRectangles: Maximum number of panels (int: [1,Inf])

- MinPerRectangle: Minimum data points per panel (int: [2,Inf])

- RectangleSize: Shrink panel to data (Boolean)

- AlphaSelectAlg: Alpha selection algorithm (mbcmodel.fitalgorithm)

Lambda Selection Algorithms
Algorithm: IterateRidge

Alternatives: `'IterateRols','StepItRols'`

- CenterSelectionAlg: Center selection algorithm (mbcmodel.fitalgorithm)

- MaxNumIter: Maximum number of updates (int: [1,100])

- Tolerance: Minimum change in log10(GCV) (numeric: [2.22045e-016,1])

- NumberOfLambdaValues: Number of initial test values for lambda (int: [0,100])

- CheapMode: Do not reselect centers for new width (Boolean)

- PlotFlag: Display (Boolean)

Algorithm: IterateRols

Alternatives: `'IterateRidge','StepItRols'`

- CenterSelectionAlg: Center selection algorithm (mbcmodel.fitalgorithm)

- MaxNumIter: Maximum number of iterations (int: [1,100])

- Tolerance: Minimum change in log10(GCV) (numeric: [2.22045e-016,1])

- NumberOfLambdaValues: Number of initial test values for lambda (int: [0,100])

- CheapMode: Do not reselect centers for new width (Boolean)

- PlotFlag: Display (Boolean)

Algorithm: StepItRols

Alternatives: `'IterateRidge'`,`'IterateRols'`

- MaxCenters: Maximum number of centers (evalstr)

- PercentCandidates: Percentage of data to be candidate centers (evalstr)

- StartLambdaUpdate: Number of centers to add before updating (int: [1,Inf])

- Tolerance: Minimum change in log10(GCV) (numeric: [2.22045e-016,1])

- MaxRep: Maximum number of times log10(GCV) change is minimal (int: [1,100])

Center Selection Algorithms
Algorithm: Rols

Alternatives: `'RedErr'`,`'WiggleCenters'`,`'CenterExchange'`

- MaxCenters: Maximum number of centers (evalstr)

- PercentCandidates: Percentage of data to be candidate centers (evalstr)

- Tolerance: Regularized error tolerance (numeric: [2.22045e-016,1])

Algorithm: RedErr

Alternatives: `'Rols','WiggleCenters','CenterExchange'`

- MaxCenters: Number of centers (evalstr)

Algorithm: WiggleCenters

Alternatives: `'Rols','RedErr','CenterExchange'`

- MaxCenters: Number of centers (evalstr)
- PercentCandidates: Percentage of data to be candidate centers (evalstr)

Algorithm: CenterExchange

Alternatives: `'Rols','RedErr','WiggleCenters'`

- MaxCenters: Number of centers (evalstr)
- NumLoops: Number of augment/reduce cycles (int: [1,Inf])
- NumAugment: Number of centers to augment by (int: [1,Inf])

Tree Regression Algorithms
Algorithm: Trial Alpha

Alternatives: `'Specify Alpha'`

- AlphaLowerBound: Initial lower bound on alpha (numeric: [2.22045e-016,Inf])
- AlphaUpperBound: Initial upper bound on alpha (numeric: [2.22045e-016,Inf])
- Zooms: Number of zooms (int: [1,Inf])
- Trials: Trial alphas per zoom (int: [2,Inf])

- Spacing: Spacing (Linear | Logarimthic)

- CenterSelectAlg: Center selection algorithm (mbcmodel.fitalgorithm)

Algorithm: Specify Alpha

Alternatives: `'Trial Alpha'`

- Alpha: Width scale parameter, alpha (numeric: [2.22045e-016,Inf])

- NestedFitAlgorithm: Center selection algorithm (mbcmodel.fitalgorithm)

Algorithm: Tree-based Center Selection

Alternatives: `'Generic Center Selection'`

- ModelSelectionCriteria: Model selection criteria (BIC | GCV)

- MaxNumberCenters: Maximum number of centers (evalstr)

Algorithm: Generic Center Selection

Alternatives: `'Tree-based Center Selection'`

- CenterSelectAlg: Center selection algorithm (mbcmodel.fitalgorithm)

Hybrid RBF Algorithms

Algorithm: RBF Fit

- WidthAlgorithm: Width selection algorithm (mbcmodel.fitalgorithm)

- StepAlgorithm: Stepwise (mbcmodel.fitalgorithm)

Width Selection Algorithms
Algorithm: TrialWidths

- NestedFitAlgorithm: Lambda and term selection algorithm (mbcmodel.fitalgorithm)

- Trials: Number of trial widths in each zoom (int: [2,100])

- Zooms: Number of zooms (int: [1,100])
- MinWidth: Initial lower bound on width (numeric: [2.22045e-016,1000])
- MaxWidth: Initial upper bound on width (numeric: [2.22045e-016,100])
- PlotFlag: Display plots (Boolean)
- PlotProgress: Display fit progress (Boolean)

Nested Fit Algorithms
Algorithm: Twostep

Alternatives: `'Interlace'`

- MaxCenters: Maximum number of centers (evalstr)
- PercentCandidates: Percentage of data to be candidate centers (evalstr)
- StartLambdaUpdate: Number of terms to add before updating (int: [1,Inf])
- Tolerance: Minimum change in log10(GCV) (numeric: [2.22045e-016,1])
- MaxRep: Maximum number of times log10(GCV) change is minimal (int: [1,100])
- PlotFlag: Display (Boolean)

Algorithm: Interlace

Alternatives: `'Twostep'`

- MaxParameters: Maximum number of terms (evalstr)
- MaxCenters: Maximum number of centers (evalstr)
- PercentCandidates: Percentage of data to be candidate centers (evalstr)

- StartLambdaUpdate: Number of terms to add before updating (int: [1,Inf])

- Tolerance: Minimum change in log10(GCV) (numeric: [2.22045e-016,1])

- MaxRep: Maximum number of times log10(GCV) change is minimal (int: [1,100])

Examples   First get a fitalgorithm object, F, from a model:

```
M = mbcmodel.CreateModel('Polynomial', 4);
F = M.FitAlgorithm

F =
Algorithm: Least Squares
Alternatives: 'Minimize PRESS','Forward Selection','Backward
Selection','Prune'
1x1 struct array with no fields.
```

Then, to create a new algorithm type:

```
Alg = CreateAlgorithm(F, 'Minimize PRESS')

Alg =
Algorithm: Minimize PRESS
Alternatives: 'Least Squares','Forward Selection','Backward
Selection','Prune'
    MaxIter: 50
```

See Also   getAlternativeNames, SetupDialog

CreateAlternativeModels

Purpose   Create alternative models from model template

Syntax   R = CreateAlternativeModels(R, modeltemplate, criteria)
R = CreateAlternativeModels(R, modellist, criteria
R = CreateAlternativeModels(R,
LocalModels,LocalCriteria,GlobalModels,GlobalCriteria)

Description   This is a method of all model objects: mbcmodel.hierarchicalresponse,
mbcmodel.localresponse and mbcmodel.response.

This is the same as the Build Models function in the Model Browser
GUI. A selection of child node models are built. The results depend on
where you call this method from. Note that the hierarchical model is
automatically constructed when CreateAlternativeModels is called
for a local model.

- This option makes alternative response feature models for each
  response feature.

      R = CreateAlternativeModels(R, models, criteria)

  - Models is the list of models. You can use a model template
    file (.mbm) created in the Model Browser, or a cell array of
    mbcmodel.model objects.

  - Criteria is the selection criteria for best model (from the statistics
    available from AlternativeModelStatistics).

- This option makes alternative local models as well as alternative
  response feature models

      R = CreateAlternativeModels(R,
      LocalModels,LocalCriteria,GlobalModels,GlobalCriteria)

  - LocalModels is the list of local models - you must pass in an
    empty matrix)

  - LocalCriteria is 'Two-Stage RMSE'

- GlobalModels is the list of global models (from the model template)

- GlobalCriteria is the selection criteria for best model

You construct a model template file (such as `'mymodels.mbm'`) in the Model Browser. From any response (global or one-stage model) with alternative responses (child nodes), select **Model > Make Template**. You can save the child node model types of your currently selected modeling node as a model template. Alternatively from any response click **Build Models** in the toolbar and create a series of alternative response models in the dialog.

Examples

```
mymodels = 'mymodels.mbm';
mlist = {};
load('-mat', mymodels);
critera = 'PRESS RMSE';
CreateAlternativeModels(R, [], 'Two-Stage RMSE', mlist,
criteria);
```

Note that the model template contains the variable `mlist`.

```
CreateAlternativeModels( RESPONSE, 'alternative_models.mbm', 'Weighted PRESS' )
```

creates alternative response feature models based upon the model template file alternative_models.mbt, and chooses the best model based upon each model's Weighted PRESS statistic.

See Also   AlternativeModelStatistics

CreateData

Purpose	Create data object
Syntax	`D = CreateData(P, filename, filetype)` `D = mbcmodel.CreateData(filename, filetype)`
Description	The first syntax is a method of `mbcmodel.project`. Use this to create a new data object in an existing project. `P` is the project object.
	`filename` and `filetype` are optional arguments that are used to load data from a file into the new data object at creation time.
	`filename` is a string specifying the full path to the file.
	`filetype` is a string specifying the file type. See `DataFileTypes` for the specification of allowed file types (and `mbccheckindataloadingfcn` to specify your own data loading function). If `filetype` is not provided, then MBC will attempt to infer the file type from the file extension, i.e. if the file extension is .xls then MBC will try the Excel File Loader.
	If `filename` is not provided then no data will be loaded into the new data object. Data can be loaded subsequently using `ImportFromFile`, provided that editing of the data object has been enabled via a call to `BeginEdit`. Call `CommitEdit` to apply edits.
	The second syntax is a function. Use this to create a new data object independent of any project.

Examples	`data = CreateData(P, 'D:\MBCWork\data1.xls');`
	`D = mbcmodel.CreateData;`
	`D = mbcmodel.CreateData('D:\MBCWork\data.xls');`

	Where P is an `mbcmodel.project` object.
See Also	`DataFileTypes`, `BeginEdit`, `CopyData`, `RemoveData`, `Data`, `ImportFromFile`, `CommitEdit`

Purpose	Create new model

Syntax
```
M = mbcmodel.CreateModel(Type, INPUTS)
NewModel = CreateModel(model,Type)
```

Description   M = mbcmodel.CreateModel(Type, INPUTS) This syntax is a function that creates an mbcmodel.model object of the specified Type.

mbcmodel.linearmodel and mbcmodel.localmodel are subclasses of mbcmodel.model. Model types that begin with the word "local" specify an mbcmodel.localmodel object.

NewModel = CreateModel(model,Type) This syntax is a function that creates a new model (of the specified Type) with the same inputs as an existing model. model is an mbcmodel.model object. You can use getAlternativeTypes to generate a list of valid model types. See Type for a list of valid model types. Spaces and case in Type are ignored.

INPUTS can be a mbcmodel.modelinput object, or any valid input to the mbcmodel.modelinput constructor. See modelinput.

Examples   To create a hybrid spline with four input factors, enter:

```
M = mbcmodel.CreateModel('Hybrid Spline', 4)
```

To create an RBF with four input factors, enter:

```
Inputs = mbcmodel.modelinput('Symbol',{'N','L','EXH','INT'}',...
    'Name',{'ENGSPEED','LOAD','EXHCAM','INTCAM'}',...
    'Range',{[800 5000],[0.1 1],[-5 50],[-5 50]}');

RBFModel = mbcmodel.CreateModel( 'RBF', Inputs);
```

To create a polynomial with the same input factors as the previously created RBF, enter:

```
PolyModel = CreateModel(RBFModel,'Polynomial')
```

See Also   getAlternativeTypes, modelinput, CreateProject, CreateData, Type

CreateProject

Purpose	Create project object
Syntax	`P = mbcmodel.CreateProject`
Description	This is a function that creates an `mbcmodel.project` object.
	P is the project object.
	`P = mbcmodel.CreateProject` creates an `mbcmodel.project` called Untitled. `P = mbcmodel.CreateProject( NAME )` creates an `mbcmodel.project` called NAME.
Examples	`P = mbcmodel.CreateProject;`
	Create a project called MBT_Project:
	`P = mbcmodel.CreateProject( 'MBT_Project' );`

Purpose   Create new response model for test plan

Syntax   R = CreateResponse(T, Varname)
                 R = CreateResponse(T, Varname, Model)
                 R = CreateResponse(T, Varname, LocalModel, GlobalModel)
                 R = CreateResponse(T, Varname, LocalModel, GlobalModel,
                   DatumType)

Description This is a method of mbcmodel.testplan.

R = CreateResponse(T, Varname) creates a model of the variable Varname using the test plan's one- or two-stage default models. T is the test plan object, R is the new response object.

R = CreateResponse(T, Varname, Model) creates a one-stage model of Varname, where T must be a one-stage test plan object.

R = CreateResponse(T, Varname, LocalModel, GlobalModel) or R = CreateResponse(T, Varname, LocalModel, GlobalModel, DatumType) creates a two-stage model of Varname. T must be a two-stage test plan object. DatumType can only be specified if the local model type permits a datum model. Only the model types "Polynomial Spline" and "Polynomial with Datum" permit datum models.

Varname is the variable name for the new response.

Model is the One-stage model object (if you leave this field empty, the default is used).

LocalModel is the Local Model object (if you leave this field empty, the default is used).

GlobalModel is the Response Feature model object (if you leave this field empty, the default is used).

DatumType can be 'None' 'Maximum' 'Minimum' or 'Linked'.

Examples   To create a response using the default models, enter:

```
R = CreateResponse(T, 'torque');
TQ_response = CreateResponse(testplan, 'TQ');
```

CreateResponse

To create a response and specify the local and global model types, enter:

```
mdls = T.DefaultModels
LocalModel = CreateModel(mdl{1}, 'Local Polynomial Spline');
GlobalModel = CreateModel(mdl{2}, 'RBF');
R = CreateResponse(T, 'TQ', LocalModel, GlobalModel, 'Maximum')
```

See Also   Responses

Purpose   Create new response feature for local model

Syntax   RF = CreateResponseFeature(RF,RFType)
                   RF = CreateResponseFeature(RF,RFType,EvaluationPoint)

Description   This is a method of mbcmodel.localresponse.

                   RF = CreateResponseFeature(RF,RFType)

                   RF = CreateResponseFeature(RF,RFType,EvaluationPoint)

                   RFType is a description string belonging to the set of alternative
                   response features for the current local model.

                   EvaluationPoint is a row vector with an element for each model input
                   and is used for response features that require an input value to evaluate
                   the response feature (e.g., function evaluation, derivatives). It is an
                   error to specify an evaluation point for a response feature type that does
                   not require an evaluation point.

                   You should use this method to add response features without refitting
                   all local and global models.

Examples   RF = CreateResponseFeature(RF,'Beta_1')

See Also   ResponseFeatures(Local Model)

CreateTestplan

Purpose   Create new test plan

Syntax
```
T = CreateTestplan(P, TestPlanTemplate)
T = CreateTestplan(P, TestPlanTemplate, newtestplanname)
T = CreateTestplan(P, InputsPerLevel)
T = CreateTestplan(P, InputsPerLevel, newtestplanname)
T = CreateTestplan(P, Inputs)
T = CreateTestplan(P, Inputs, newtestplanname)
```

Description   This is a method of the `mbcmodel.project` object.

You can use this method with a test plan template or input information.

You set templates up in the Model Browser GUI. This setup includes number of stages, inputs, base models, and designs. If the test plan is used as part of a previous project it is also possible to save response models in the test plan. It is not possible to change the number of stages after creation of the test plan.

After you create a new test plan, you can add data to model, and new responses. Note that the model input signal names specified in the template *must* match the signal names in the data.

Use CreateTestplan in the following ways:
```
T = CreateTestplan(P, TestPlanTemplate)

T = CreateTestplan(P, TestPlanTemplate, newtestplanname)
```

P is the project object.

TestPlanTemplate is the full name and path to the test plan template file created in the Model Browser.

newtestplanname is the optional name for the new test plan object.
```
T = CreateTestplan(P, InputsPerLevel)

T = CreateTestplan(P, InputsPerLevel, newtestplanname)
```

InputsPerLevel is a row vector with number of inputs for each stage.

```
T = CreateTestplan(P, Inputs)
```

```
T = CreateTestplan(P, Inputs, newtestplanname)
```

`Inputs` is a cell array with input information for each level. The input information can be specified as a cell array of `mbcmodel.modelinput` objects (one for each level), or as a cell array of cell arrays (one for each level).

Examples   To create a test plan using a test plan template, enter:

```
T = CreateTestplan(P1, 'd:\MBCwork\TQtemplate1', 'newtestplan')
```

```
testplan = CreateTestplan(P, 'example_testplan')
```

To create a test plan using inputs per level, enter:

```
T = P.CreateTestplan([1,2])
```

To specify the input information in a cell array of `mbcmodel.modelinput` objects, enter:

```
% Define Inputs for test plan
LocalInputs = mbcmodel.modelinput('Symbol','S',...
    'Name','SPARK',...
    'Range',[O 50]);
GlobalInputs = mbcmodel.modelinput('Symbol',{'N','L','ICP',...
'ECP'},'Name',{'SPEED','LOAD','INT_ADV','EXH_RET'},...
    'Range',{[500 6000],[0.0679    0.9502],[-5 50],[-5 50]});
% create test plan
testplan = CreateTestplan( project, {LocalInputs,...
GlobalInputs} );
```

Or

```
T = P.CreateTestplan({LocalInputs,GlobalInputs})
```

To specify the input information in a cell array, enter:

```
localInputs = {'S',0,50,'','SPARK'};
globalInputs = {'N',   800, 5000, '', 'ENGSPEED'
               'L',   0.1,    1, '', 'LOAD'
               'EXH',  -5,   50, '', 'EXHCAM'
               'INT',  -5,   50, '', 'INTCAM'};

T = CreateTestplan(P,{localInputs,globalInputs});
```

See Also   AttachData, CreateResponse, Responses, Data, Levels,
                InputSignalNames, InputsPerLevel, Inputs, modelinput

Purpose   Array of data objects in project or test plan

Syntax   allD = project.Data
                     allD = testplan.Data

Description   This is a property of mbcmodel.project and mbcmodel.testplan.

It returns an array of mbcmodel.data objects. There may be many data objects in a project, but a test plan can only have one or none.

Examples   allD = P.Data;

For a project object P, this example returns an nx1 array of all the data objects.

                        allD = T.Data;

For the test plan object T, this example returns a 1x1 array if the test plan has a data object attached, and 0x1 otherwise.

See Also   CreateData, RemoveData, CopyData

DataFileTypes

Purpose	Data file types
Syntax	`f = mbcmodel.DataFileTypes`
Description	This is a function to return a list of data file types for `mbcmodel`.

Examples

```
f = mbcmodel.DataFileTypes

f =

  Columns 1 through 4
    'Excel file'    'FT/DB data files'    'Delimited Text File'
  [1x25 char]
  Column 5
    'MATLAB Data File'
```

See Also   `ImportFromFile`, `CreateData`

Purpose   Inputs for test plan

Syntax   `testplan.DefaultModels`

Description   This is a read-only property of `mbcmodel.testplan`. It returns a cell array of `mbcmodel.modelinput` objects (one array for each stage).

Examples   To get the default model objects for use in creating a response, enter:

```
mdls = T.DefaultModels
LocalModel = CreateModel(mdl{1}, 'Local Polynomial Spline');
GlobalModel = CreateModel(mdl{2}, 'RBF');
R = CreateResponse(T, 'TQ', LocalModel, GlobalModel, 'Maximum')
```

See Also   `CreateResponsemodelinput`

DefineNumberOfRecordsPerTest

Purpose	Define exact number of records per test
Syntax	D = DefineNumberOfRecordsPerTest(D, number, testnumAlias)
Description	This is a method of `mbcmodel.data`.

You can use this to set one test per record for one-stage modeling.

`number` is the input specifying the number of records to include in each test. Most usually this will be used to specify one test per record.

`testnumAlias` is an optional string input to define the `SignalName` that should be used as the testnumber within MBC. Defaults to the index of the test.

Note `testnumaAias` uses the first record in the test as the testnumber, and testnumbers *are* unique so any duplicates will be modified.

Examples	`DefineNumberOfRecordsPerTest(D, 1);` `DefineNumberOfRecordsPerTest(D, 10, 'MYLOGNO');`
See Also	`DefineTestGroups`

Purpose   Define rule-based test groupings

Syntax   `D = DefineTestGroups(D, variables, tolerances, testnumAlias, reorder)`

Description   This is a method of `mbcmodel.data`.

You can impose rules to collect records of the current data set (`D`) into groups; these groups are referred to as **tests**. Test groupings are used to define hierarchical structure in the data for two-stage modeling.

Select a variable or variables to group by and set `tolerances`. The tolerance is used to define groups: on reading through the data, when the value of any specified variable changes by more than the tolerance, a new group is defined.

`variables` is the input cell array of strings holding the `SignalNames` on which to define the test groupings

`tolerances` is the input double array of the same length as variables holding the required tolerances for the test grouping definition

`testnumAlias` is an optional string input to define the `SignalName` that should be used as the testnumber within MBC. Defaults to the index of the test.

Note `testnumAlias` uses the first record in the test as the testnumber, and testnumbers *are* unique so any duplicates will be modified.

`reorder` is an optional Boolean indicating that the data should be reordered within the data set. Defaults to `false`.

See the section on Test Groupings (under Data) in the Model Browser User's Guide for more information on these inputs.

Examples   `DefineTestGroups(D, {'AFR' 'RPM'}, [0.1 30], 'MYLOGNO', false);`

DefineTestGroups

See Also   DefineNumberOfRecordsPerTest, NumberOfTests

Purpose   Detach data from test plan

Syntax   T = DetachData(T)

Description   This is a method of mbcmodel.testplan.

T is the test plan object. A test plan can only use a single data set, so you do not need to specify the data object.

Examples   DetachData(T1);

See Also   AttachData

DiagnosticStatistics

Purpose   Diagnostic statistics for response

Syntax   S = DiagnosticStatistics(R, TestNumbers, Stats)

Description   This is a method of the local and response model objects,
                   mbcmodel.localresponse and mbcmodel.response.

                   The options available are model-specific and are the same options
                   shown in the drop-down menus of the scatter plots (the top plots) in the
                   local and global (response feature) model views of the toolbox GUI.

                   S is a structural array containing Statistics and Names fields.

                   R is the response model object.

                   Testnumbers specifies the index into tests for local or hierarchical
                   models.

                   Stats is an optional input that defines which diagnostic statistics you
                   want from the available list. If you don't specify Stats, you get all
                   available statistics.

                   A row is set to NaN if that point is removed.

Examples   studentRes = DiagnosticStatistics(local, tn, 'Studentized
                     residuals');

See Also   SummaryStatistics, AlternativeModelStatistics

Purpose   Data being used as input to model

Syntax   X = DoubleInputData(R, TestNumber)

Description   This is a method of all model objects: mbcmodel.hierarchicalresponse, mbcmodel.localresponse and mbcmodel.response. It returns an array (X) containing the input data used for fitting the model.

R is the response model object

TestNumber is an optional input to specify the tests you want.

Examples   X = DoubleInputData(R);
                   x = DoubleInputData(local, tn);

See Also   DoubleResponseData

DoubleResponseData

Purpose   Data being used as output to model for fitting

Syntax   Y = DoubleResponseData(R, TestNumber)

Description   This is a method of all model objects: `mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse` and `mbcmodel.response`. It returns an array (Y) containing the response data used for fitting the model.

R is the response model object.

TestNumber is an optional input to specify the tests you want.

Examples
```
Y = DoubleResponseData(R);
y = DoubleResponseData(local, tn);
```

See Also   DoubleInputData

Purpose   Evaluate model

Syntax   Y = Evaluate(M, X)

Description This is a method of mbcmodel.model.

Y = Evaluate(M, X) evaluates the model at X.

X is a (*numpoints*-by-*nfactors*) array.

Y is a (*numpoints*-by-1) array.

See Also   PredictedValue, PEV

Export

Purpose	Make command-line or Simulink® export model
Syntax	`ExportedModel = Export(MODEL)` `ExportedModel = Export(MODEL, Format)`
Description	This is a method of these model objects: `mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse`, `mbcmodel.response` and `mbcmodel.model`.

Syntax

```
ExportedModel = Export(MODEL)
ExportedModel = Export(MODEL, Format)
```

Description   This is a method of these model objects:
`mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse`,
`mbcmodel.response` and `mbcmodel.model`.

`ExportedModel = Export(MODEL)` exports the model to MATLAB®.

`ExportedModel = Export(MODEL, Format)` exports the model in the
specified format, which can be `'MATLAB'` or `'Simulink'`.

`Format` must be `'MATLAB'` or `'Simulink'`; an error will be thrown if
this is incorrect.

You can evaluate models exported to the MATLAB workspace in the
same way as when exported from the Model Browser. You can save
these models as a `*.mat` file and load them into CAGE.

`Model` is the object containing the response models from the node you
are exporting from.

Examples
```
M = Export(R2, 'MATLAB');
mbt_model = Export(maxTQ, 'MATLAB');
```

Purpose　　　Export data to MBC data structure

Syntax　　　`mbcStruct = ExportToMBCDataStructure (D)`

Description　　This is a method of `mbcmodel.data`.

It converts the specified data object (`D`) to the MBC Data Structure format.

An MBC Data Structure is a structure array that contains the following fields:

- `varNames` is a cell array of strings that hold the names of the variables in the data (`1xn` or `nx1`)

- `varUnits` is a cell array of strings that hold the units associated with the variables in varNames (`1xn` or `nx1`). This array can be empty, in which case no units are defined

- `data` is an array that holds the values of the variables (`m x n`)

- `comment` is an optional string holding comment information about the data.

For more information see the Data Loading Function section (under Data) in the Model Browser User's Guide ("Data Loading Application Programming Interface"). See also `mbccheckindataloadingfcn` to specify your own data loading function.

Examples　　　`X = ExportToMBCDataStructure(D1);`

See Also　　`ImportFromMBCDataStructure`

Filename

Purpose   Full path to project file

Syntax   `Name = P.Filename`

Description   This is a property of `mbcmodel.project`.

Examples   `Name = P.Filename;`

Purpose   Structure array holding user-defined filters

Syntax   `filt = D.Filters`

Description   This is a property of `mbcmodel.data`.

It returns a structure array holding information about the currently defined filters. The array will be the same length as the number of currently defined filters, with the following fields for each filter:

- `Expression` — The string expression as defined in `AddFilter` or `ModifyFilter`

- `AppliedOK` — Boolean indicating that the filter was successfully applied

- `RemovedRecords` — Boolean vector indicating which records the filter removed. Note that many filters could remove the same record

- `Message` — String holding information on the success or otherwise of the filter

Examples   `filt = D.Filters;`

See Also   `AddFilter`, `ModifyFilter`, `RemoveFilter`

FitAlgorithm

Purpose	Fit algorithm for model
Syntax	`F = M.FitAlgorithm`
Description	This is a property of `mbcmodel.model`.
	An mbcmodel.model.FitAlgorithm object is contained within the FitAlgorithm property of an mbcmodel.model object. This object has a Name property, and the following methods: CreateAlgorithm, getAlternativeNames, IsAlternative, SetupDialog, properties.
Examples	To get a fitalgorithm object, F, from a model:

```
M = mbcmodel.CreateModel('Polynomial', 4);
F = M.FitAlgorithm

F =
Algorithm: Least Squares
Alternatives: 'Minimize PRESS','Forward Selection','Backward
Selection','Prune'
1x1 struct array with no fields.
```

See Also	CreateAlgorithm, getAlternativeNames, IsAlternative, SetupDialog.

Purpose   Fit model to new or existing data, and provide summary statistics

Syntax   [statistics, model] = Fit(model, optional X, optional Y)

Description   This is a method of mbcmodel.model.

                  [statistics, model] = Fit(model, optional X, optional Y)
                  This fits the model to new data or its existing data. If X and Y are not
                  specified then the existing model XData and YData are used, otherwise
                  X and Y are placed in XData and YData and the model fitted.

                  The statistics returned are defined by the summary statistics
                  for the response object the model came from. To see these call
                  SummaryStatistics. These are the statistics that appear in the
                  Summary Statistics pane of the Model Browser GUI. The statistics
                  returned depend on the model type.

                  For a linear model, the statistics are:

                  'Observations','Parameters','Box-Cox','PRESS RMSE','RMSE'.

                  For a neural net model:

                  'Observations','Parameters', 'Box-Cox','RMSE', 'R^2'.

Examples   statistics = Fit(knot)
                      statistics =
                         27.0000   7.0000   1.0000   3.0184   2.6584

See Also   SummaryStatistics, UpdateResponse

GetAllTerms

Purpose   List all model terms

Syntax   `Terms = M.Properties.GetAllTerms`

Description   This is a method of `mbcmodel.linearmodelproperties`.

`Terms = M.Properties.GetAllTerms` returns a list of all terms in this model. M is an `mbcmodel.linearmodel` object.

`Terms` is a (*numterms*-by-*nfactors*) array. The $(m,n)^{\text{th}}$ element is the power of the nth factor in the mth term.

Examples   The following example creates a model, and finds which terms are quadratic in the first input factor (X1):

```
mdl = mbcmodel.CreateModel('Polynomial', 2)

mdl =

    1 + 2*X1 + 8*X2 + 3*X1^2 + 6*X1*X2 + 9*X2^2 + 4*X1^3
      + 5*X1^2*X2 + 7*X1*X2^2 + 10*X2^3
    InputData: [0x2 double]
    OutputData: [0x1 double]
    Status: Not fitted
    Linked to Response: <not linked>

>>terms = mdl.Properties.GetAllTerms;
>>x1quadraticterms = find(terms(:,1)==2)

x1quadraticterms =

     4
     8
```

See Also   `GetIncludedTerms`

Purpose   List alternative algorithm names

Syntax   F.getAlternativeNames
                 AltList = getAlternativeNames(F)

Description This is a method of mbcmodel.fitalgorithm.

                 F.getAlternativeNames or AltList = getAlternativeNames(F)
                 return a cell array of alternative algorithm names. F is a
                 mbcmodel.fitalgorithm object.

Examples
```
mdl = mbcmodel.CreateModel('Polynomial', 2);
F = mdl.FitAlgorithm;
altAlgs = F.getAlternativeNames

altAlgs =

    'Least Squares'    'Minimize PRESS'    'Forward Selection'
  'Backward Selection'    'Prune'
```

See Also   CreateAlgorithm, IsAlternative

getAlternativeTypes

Purpose	Alternative model types
Syntax	`list = getAlternativeTypes(mdl)`
Description	This is a method of `mbcmodel.model`.
	`list = getAlternativeTypes(mdl)` returns a cell array of alternative model types with the same number of inputs as `mdl`.

Examples

```
mdl = mbcmodel.CreateModel('RBF', 2);
altmodels = getAlternativeTypes(mdl)
```

This produces the output:

```
altmodels =

  Columns 1 through 6

    'Polynomial'    'Hybrid Spline'    'RBF'    'Polynomial-RBF'    'Hy
     'Multiple Linear'

  Columns 7 through 8

    'Neural Network'    'Transient'
```

See Also   Type, CreateModel

Purpose   Design points from test plan

Syntax   `design = GetDesignMatrix(T)`

Description   This is a method of `mbcmodel.testplan`.

It returns a double array holding the values of the design points.

Examples   `design = GetDesignMatrix(T);`

GetIncludedTerms

Purpose   List included model terms

Syntax   `Terms = M.Properties.GetIncludedTerms`

Description   This is a method of `mbcmodel.linearmodelproperties`.

`Terms = M.Properties.GetIncludedTerms` returns a list of those terms that will be used to fit the model. `M` is an `mbcmodel.linearmodel` object.

`Terms` is a (*numincludedterms*-by-*nfactors*) array. The $(m,n)^{\text{th}}$ element is the power of the nth factor in the mth included term.

Examples
```
>>mdl = mbcmodel.CreateModel('Polynomial', 2);


>>includedterms = mdl.Properties.GetIncludedTerms;
>>x1quadraticterms = find(includedterms(:,1)==2)

x1quadraticterms =

    4
    8
```

See Also   `GetAllTerms`, `SetTermStatus`

Purpose   List labels for model terms

Syntax
```
Labels = M.Properties.GetTermLabel
Labels = M.Properties.GetTermLabel( Terms )
Labels = M.Properties.GetTermLabel( Terms, 'Format',
   OutputFormat )
```

Description   This is a method of `mbcmodel.linearmodelproperties`, which returns a user-friendly label for one or more specified terms.

`Labels = M.Properties.GetTermLabel`

`Labels = M.Properties.GetTermLabel( Terms )`

`Labels = M.Properties.GetTermLabel( Terms, 'Format', OutputFormat )`

`M` is an `mbcmodel.linearmodel` object.

The specified terms form a row where each value gives the power of that parameter. `OutputFormat`

can be `'List'` or `'Formula'`.

Examples
```
mdl = mbcmodel.CreateModel('Polynomial', 2);
mdl.Properties.GetTermLabel([1 2; 1 0] )
```

produces `{'X1*X2^2';'X1'}` and

```
mdl.Properties.GetTermLabel([1 2; 1 0], 'Format', 'Formula' )
```

produces `'X1*X2^2 + X1'`.

See Also   `GetAllTerms`, `GetIncludedTerms`

GetTermStatus

Purpose	List status of some or all model terms
Syntax	`Status = M.Properties.GetTermStatus` `Status = M.Properties.GetTermStatus(Terms)`
Description	This is a method of `mbcmodel.linearmodelproperties`.

`Status = M.Properties.GetTermStatus` returns the status of all of the terms in this model. `Status` is a cell array of status strings. `M` is an `mbcmodel.linearmodel` object.

`Status = M.Properties.GetTermStatus(Terms)` returns the status of the specified terms in this model.

The stepwise status for each term can be 'Always', 'Never' or 'Step'. The status determines whether you can use the StepwiseRegression function to throw away terms in order to try to improve the predictive power of the model.

Examples

```
mdl = mbcmodel.CreateModel('Polynomial', 2);
```

Get status of $X2^3$ term:

```
status = mdl.Properties.GetTermStatus([O 3])

status =

    'Step'
```

Get status of all terms linear in X1:

```
status = mdl.Properties.GetTermStatus([1 O; 1 1; 1 2])

status =

    'Step'
    'Step'
    'Step'
```

2-64

See Also   SetTermStatus, StepwiseStatus

ImportFromFile

Purpose   Load data from file

Syntax   `D = ImportFromFile(D, filename, filetype)`

Description   This is a method of the `mbcmodel.data` object.

First you must use `CreateData`, than `BeginEdit` before you can call
ImportFromFile to bring data into your new data object, `D`.

Note that you can specify `filename` and `filetype` when you call
`CreateData` as a shortcut for loading data from a file. You still need to
call `BeginEdit` before you can make changes to the data.

`filename` is a string holding the full path to the file to load.

`filetype` is an optional file type to load. See `DataFileTypes` for the
specification of the allowed file types (and `mbccheckindataloadingfcn`
to specify your own data loading function).

Filetype defaults to 'auto' which will attempt to guess the filetype based
on the extension of the file being loaded. i.e. if the file extension is .xls
then MBC will try the Excel File Loader.

Examples   `ImportFromFile(D, 'D:\MBCData\Raw Data\testdata.xls');`

See Also   `CreateData`, `DataFileTypes`, `BeginEdit`,
`ImportFromMBCDataStructure`, `RemoveData`, `Append`

Purpose   Load data from MBC data structure

Syntax   `D = ImportFromMBCDataStructure(D, mbcStruct)`

Description   This is a method of `mbcmodel.data`.

First you must use `CreateData`, than `BeginEdit` before you can bring data into your new data object.

An MBC Data Structure is a structure array that contains the following fields:

- `varNames` is a cell array of strings that hold the names of the variables in the data (`1xn` or `nx1`)

- `varUnits` is a cell array of strings that hold the units associated with the variables in varNames (`1xn` or `nx1`). This array can be empty, in which case no units are defined

- `data` is an array that holds the values of the variables (`m x n`)

- `comment` is an optional string holding comment information about the data.

For more information see the Data Loading Function section (under Data) in the *Model Browser User's Guide* ("Data Loading Application Programming Interface"), and see also `mbccheckindataloadingfcn` to specify your own data loading function.

Examples   `ImportFromMBCDataStructure(D, mbcStruct);`

See Also   `ImportFromFile`, `CreateData`, `BeginEdit`, `RemoveData`, `Append`, `ExportToMBCDataStructure`

InputData

Purpose	Input data for model
Syntax	`D = M.InputData`
Description	This is a property of `mbcmodel.model`. It returns an array of the input variable data currently in the model.
Examples	`D = knot.InputData;`
See Also	`OutputData`

Purpose   Inputs for test plan

Syntax   ```
testplan.Inputs
model.Inputs
```

Description   This is a property of `mbcmodel.testplan` and `mbcmodel.model`.

For `mbcmodel.testplan`, this property returns a cell array of `mbcmodel.modelinput` objects (one array for each stage). You cannot change the number of stages after creation of the test plan.

For `mbcmodel.model`, this property returns an `mbcmodel.modelinput` object. It is not editable when attached to a response. You cannot change number of inputs after creation.

In both cases, verification of valid variable names and symbols occurs before assigning inputs to model at the command line. Names and Symbols must be unique.

See Also   `CreateTestplan`, `modelinput`

InputSetupDialog

Purpose   Open Input Setup dialog box to edit inputs

Syntax   [NEWMODEL, OK] = InputSetupDialog(OLDMODEL)
                 [NEWTESTPLAN, OK] = InputSetupDialog(OLDTESTPLAN)

Description This is a method of `mbcmodel.model` and `mbcmodel.testplan`.

[NEWMODEL, OK] = InputSetupDialog(OLDMODEL) opens the Input Setup dialog box, where you can edit the model inputs (names, symbols, and ranges).

[NEWTESTPLAN, OK] = InputSetupDialog(OLDTESTPLAN) opens the Input Setup dialog box, where you can edit the test plan inputs (names, symbols, and ranges).

If you click **Cancel** to dismiss the dialog box, OK = `false` and NEWMODEL = OLDMODEL. If you click **OK** to close the dialog box, then OK = `true` and NEWMODEL is your new chosen model setup. The new model is refitted when you click OK.

Purpose   Names of signals in data that are being modeled

Syntax   inputs = A.InputSignalNames

Description   This is a property of mbcmodel.testplan and the modeling objects
                  mbcmodel.hierarchicalresponse, mbcmodel.localresponse and
                  mbcmodel.response.

                  A can be a test plan (T) or model (L, R, HR) object.

Examples   inputs = T.'InputSignalNames;

                      InputFactors = thisRF.InputSignalNames';

See Also   SignalNames

InputsPerLevel

Purpose   Number of inputs at each level in model

Syntax   `L = T.InputsPerLevel`

Description   This is a property of `mbcmodel.testplan`.

This is a vector of length `Levels`. Each element defines the number of inputs at that level. See "Understanding Model Structure" for an explanation of the levels in a test plan.

Examples

```
L = T.InputsPerLevel
L =
  2  4
```

This answer means the test plan `T` has 2 local inputs and 4 global inputs.

See Also   `Levels, Level`

Purpose   Test alternative fit algorithm

Syntax   OK = IsAlternative(F1, F2)

Description   This is a method of mbcmodel.fitalgorithm.

OK = IsAlternative(F1, F2) tests whether F is an alternative
mbcmodel.fitalgorithm for F1.

See Also   CreateAlgorithm, getAlternativeNames

IsBeingEdited

Purpose	Boolean signaling if data or model is being edited
Syntax	`OK = D.IsBeingEdited`
Description	This is a property of `mbcmodel.data` and `mbcmodel.model`. This Boolean property indicates that the data or model is currently being edited. For data, it also indicates that previously there was a successful call to `BeginEdit` and hence that whatever changes have been applied can be undone by calling `RollbackEdit`. It does not indicate that a call to `CommitEdit` will necessarily succeed. See `CommitEdit` for an example of this case.

Examples	`OK = D.IsBeingEdited;`
	
	`OK = knot.IsBeingEdited;`

See Also	`BeginEdit`, `IsEditable`, `CommitEdit`, `RollbackEdit`

Purpose   Boolean signaling whether data is editable

Syntax   OK = D.IsEditable

Description   This is a property of `mbcmodel.data`.

This Boolean property indicates if a particular piece of data is editable. The following rules apply

- If the data was created using `mbcmodel.CreateData` and was not `Attached` to a test plan it is editable.

- If the data was created or retrieved from the project and was not `Attached` to a test plan it is editable.

- If the data was `Attached` to a test plan and was subsequently retrieved from that test plan it is editable.

Examples
```
D  = p.Data;
D1 = p.Data;
BeginEdit(D1);
tp = p.Testplan;
Attach(tp, D);
```

Where `p` is an `mbcmodel.project` object, and `D` and `D1` are `mbcmodel.data` objects.

At this point `D1.IsEditable` becomes false because `D1` is now `Attached` to the test plan and hence can only be modified from the test plan. If you now enter:

```
OK = D1.IsEditable
```

the answer is `false`.

See Also   BeginEdit, IsBeingEdited, CommitEdit, RollbackEdit

Jacobian

Purpose   Calculate Jacobian matrix for model at existing or new X points

Syntax   J = Jacobian(model, optional X)

Description   This is a method of `mbcmodel.model`.

This calculates the Jacobian matrix for the model at existing or new X points. If X is not specified then the existing XData is used. The Jacobian is the regression matrix for linear models and RBF models.

The Jacobian matrix (for linear and RBF models) is the same as the Regression Matix in the Design Evaluation Tool GUI. These matrices only include the terms currently selected in the model.

If all terms are included (none removed by Stepwise) then the Jacobian (for linear and RBF models) is the same as the Full FX matrix found in the Design Evaluation Tool GUI. The Jacobian matrix only includes the currently selected model terms.

To determine the condition number, use the MATLAB command `cond(J)`.

Examples   J = Jacobian(knot),

See Also   XData

Purpose   Level in test plan of response

Syntax   `level = R.Level`

Description   This is a property for all model objects:
                   `mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse` and
                   `mbcmodel.response`.

                   R is the response for which you want the level.

                   The level is usually 0 for hierarchical models, usually 1 for local models,
                   and usually 2 or 1 for response models. See "Understanding Model
                   Structure" for an explanation of what `Level` indicates about a response.

Examples   `level = R.'Level;`

See Also   `Levels`

Levels

Purpose   Number of levels in hierarchical model

Syntax   `levels = T.'Levels`

Description   This is a property of `mbcmodel.testplan`.

See "Understanding Model Structure" for an explanation of what `Levels` mean.

Examples   `levels = T.'Levels;`

See Also   `Level`

Purpose	Load existing project file
Syntax	P = Load(P, Filename)
Description	This is a method of mbcmodel.project.
	P is a project object, and Filename is the full path to the project you want to load.
Examples	P2 = Load(P2, 'D:/MBCwork/TQproject2.mat');
See Also	New

LoadProject

Purpose	Load mbcmodel.project
Syntax	`P = MBCMODEL.LOADPROJECT( FILENAME )`
Description	`P = mbcmodel.LoadProject( FILENAME )` loads a mbcmodel.project from the file FILENAME.
Examples	
See Also	`CreateProject`, `Load`

Purpose   Edit local model properties

Syntax   Props = localmodel.Properties

Description   This is a property of the mbcmodel.localmodel object, which is a
subclass of mbcmodel.model.

See "Understanding Model Structure" for an explanation of the
relationship between the different response types.

Every local model object has an mbcmodel.modelproperties object
(within the Properties property). In this object, each local model type
has specific properties, as described in the following tables.

Local Polynomial Properties

Property	Description
Order	Polynomial order (vector int: {[0,Inf],2})
InteractionOrder	Maximum order of interaction terms (int: [0,Inf])
TransformInputRange	Transform inputs (Boolean)
ParameterNames	List of parameter names (read-only)
StepwiseStatus	Stepwise status {'Always','Never','Step'} (cell)
Transform	Transform function (char) or empty ('')

LocalModel Properties

Local Polynomial Properties (Continued)

Property	Description
CovarianceModel	Covariance Model (enum: {'None','Power', 'Exponential','Mixed'})
CorrelationModel	Correlation Model (enum: {'None','MA(1)','AR(1)', 'AR(2)'})

Local Hybrid Spline Properties

Property	Description
Order	Spline and polynomial order (vector int: {[0,3],2})
SplineVariable	Spline variable
SplineInteraction	Order of interaction between spline and polynomial (int: [0,3])
Knots: Position of knots (vector real)	ParameterNames: List of parameter names (read-only)
StepwiseStatus	Stepwise status {'Always','Never','Step'} (cell)
Transform	Transform function (char) or empty ('')

Local Hybrid Spline Properties (Continued)

Property	Description
CovarianceModel	Covariance Model (enum: {'None','Power', 'Exponential','Mixed'})
CorrelationModel	Correlation Model (enum: {'None','MA(1)','AR(1)', 'AR(2)'})

Local Polynomial Spline Properties

Property	Description
HighOrder	Polynomial order above knot (int: [2,Inf])
LowOrder	Polynomial order below knot (int: [2,Inf])
Transform	Transform function (char) or empty ('')
CovarianceModel	Covariance Model (enum: {'None','Power', 'Exponential','Mixed'})
CorrelationModel	Correlation Model (enum: {'None','MA(1)','AR(1)', 'AR(2)'})
DatumType	Datum Type (enum: {'None','Maximum','Minimum', 'Linked'})

LocalModel Properties

Local Polynomial With Datum Properties

Property	Description
Order	Polynomial order (int: `[0,Inf]`)
Transform	Transform function (char) or empty (`''`)
CovarianceModel	Covariance Model (enum: `{'None','Power', 'Exponential','Mixed'}`)
CorrelationModel	Correlation Model (enum: `{'None','MA(1)','AR(1)', 'AR(2)'}`)
DatumType	Datum Type (enum: `{'None','Maximum','Minimum', 'Linked'}`)

Local Free Knot Spline Properties

Property	Description
Order	Spline Order (int: `[0,Inf]`)
NumKnots	Number of knots (int: `'Positive'`)
Transform	Transform function (char) or empty (`''`)
CovarianceModel	Covariance Model (enum: `{'None','Power', 'Exponential','Mixed'}`)
CorrelationModel	Correlation Model (enum: `{'None','MA(1)','AR(1)', 'AR(2)'}`)

Local Truncated Power Series Properties

Property	Description
Order	Polynomial order (int: `'Positive'`)
NumKnots	Number of knots (int: `'Positive'`)
Transform	Transform function (char) or empty (`''`)
CovarianceModel	Covariance Model (enum: `{'None','Power', 'Exponential','Mixed'}`)
CorrelationModel	Correlation Model (enum: `{'None','MA(1)','AR(1)', 'AR(2)'}`)

Local Growth Properties

Property	Description
Model	Growth model (enum: `{'expgrowth','gomp', 'logistic','logistic4', 'mmf','richards', 'weibul'}`)
AlternativeModels	List of growth models (read-only)
Transform	Transform function (char) or empty (`''`)
TransformBothSides	Transform both sides (Boolean)

LocalModel Properties

Local Growth Properties (Continued)

Property	Description
CovarianceModel	Covariance Model (enum: {'None','Power', 'Exponential','Mixed'})
CorrelationModel	Correlation Model (enum: {'None','MA(1)','AR(1)', 'AR(2)'})

Local User-Defined Properties

Property	Description
Model	Name of user-defined model (enum: {'exponential'})
AlternativeModels	List of registered user-defined models (read-only)
Transform	Transform function (char) or empty ('')
TransformBothSides	Transform both sides (Boolean)
CovarianceModel	Covariance Model (enum: {'None','Power', 'Exponential','Mixed'})
CorrelationModel	Correlation Model (enum: {'None','MA(1)','AR(1)', 'AR(2)'})

Local Transient Properties

Property	Description
Model	Name of transient model (enum: `{'fuelPuddle'}`)
AlternativeModels	List of registered transient models (read-only)
Transform	Transform function (char) or empty (`''`)
TransformBothSides	Transform both sides (Boolean)
CovarianceModel	Covariance Model (enum: `{'None','Power', 'Exponential','Mixed'}`)
CorrelationModel	Correlation Model (enum: `{'None','MA(1)','AR(1)', 'AR(2)'}`)

Local Multiple Models Properties

Property	Description
ModelCandidates	List of candidate models (cell)
SelectionStatistic	Selection statistic for automatic model selection (char)

LocalModel Properties

Local Multiple Models Properties (Continued)

Property	Description
AutomaticInputRanges	Use data range as model input ranges (Boolean)
Transform	Transform function (char) or empty ('')

Local Average Fit Properties

Property	Description
Model	[1x1 mbcmodel.linearmodel]
Transform	Transform function (char) or empty ('')

Examples

To create a local model object, create a model specifying any model Type that begins with the word "local", e.g.,

```
L = mbcmodel.CreateModel('Local Polynomial',2);
```

To show properties, at the command line enter:

```
P = L.Properties

P =
Local Polynomial Properties
                  Order: [3 3]
       InteractionOrder: 3
     TransformInputRange: 1
          ParameterNames: {10x1 cell}
          StepwiseStatus: {10x1 cell}
               Transform: ''
         CovarianceModel: 'None'
        CorrelationModel: 'None'
```

To set the Order property to a quadratic, enter:

```
>> P.Order = [2,2]

P =
Local Polynomial Properties
                   Order: [2 2]
        InteractionOrder: 2
     TransformInputRange: 1
          ParameterNames: {6x1 cell}
          StepwiseStatus: {6x1 cell}
               Transform: ''
         CovarianceModel: 'None'
        CorrelationModel: 'None'
```

To update the local model, the properties object must be reassigned to the model as follows:

```
>> L.Properties = P

L =

    1 + 2*X1 + 5*X2 + 3*X1^2 + 4*X1*X2 + 6*X2^2
    InputData: [0x2 double]
    OutputData: [0x1 double]
    Status: Being Edited
    Linked to Response: not linked
```

See Also   CreateModel, Type, ResponseFeatures(Local Model)

LocalResponses

Purpose   Array of local responses for response

Syntax   `local = response.LocalResponses`

Description   This is a property of the `mbcmodel.hierarchicalresponse` object.

It returns the local model response objects that belong to the hierarchical response `R`.

See "Understanding Model Structure" for an explanation of the relationship between the different response types.

Examples   `local = response.LocalResponses;`

MakeHierarchicalResponse

Purpose Build two-stage model from response feature models

Syntax OK = MakeHierarchicalResponse(L,MLE)

Description This method of mbcmodel.localresponse builds a two-stage model from the response feature models and optionally runs MLE (Maximum Likelihood Estimation). If there are more response features than the number of parameters in the local model, the subset of response features that leads to the best hierarchical response is chosen. The best hierarchical response is chosen using PRESS RMSE (root mean square prediction error — see "PRESS statistic") if all the response feature models are linear. Otherwise, the best hierarchical response is chosen using Two-stage RMSE.

This performs a similar function to ChooseAsBest for response models. You can call MakeHierarchicalResponse directly or indirectly by calling CreateAlternativeModels for a local model. If you call CreateAlternativeModels for a local model, MakeHierarchicalResponse is called automatically.

If the local and response models are not ready to calculate a two-stage model, an error is generated. This situation can occur if you have created alternative models and not chosen the best. A sufficient number of response features models to calculate the two-stage model must be selected.

L is the local model object

MLE can be true or false. If true, MLE will be calculated.

Examples OK = MakeHierarchicalResponse(L, true)

See Also ChooseAsBest

Model

Purpose   Model object within response object

Syntax   `M = response.Model`

Description   This is a property of all mbcmodel.response objects.

Each response contains a model object (`mbcmodel.model`) that can be extracted and manipulated independently of the project.

Extract a model object from any response object (see `Response`), and then:

- Fit to new data (`Fit`).
- Change model type, properties, and fit algorithm settings (`ModelSetup`, `Type`; `Properties`, `CreateAlgorithm`).
- Create a copy of the model with the same inputs (`CreateModel`).
- Include and exclude terms to improve the model (`StepwiseRegression`).
- Examine coefficient values, predicted values, and regression matrices (`ParameterStatistics`; `PredictedValue`; `Jacobian`).
- If you change the model you need to use `UpdateResponse` to replace the new model back into the response object in the project. When you use `UpdateResponse` the new model is fitted to the response data.

Examples   `M = response.Model;`

Purpose   Model for specified test

Syntax   `mdl = ModelForTest(L,TestNo);`

Description   This is a method of `mbcmodel.localresponse`.

                   `mdl = ModelForTest(L,TestNo);`

Examples   To get the model for test 22, enter:

                       `mdl = ModelForTest(L,22);`

modelinput

Purpose   Create modelinput object

Syntax
```
Inputs = mbcmodel.modelinput('PropertyName1',value1,
    'PropertyName2',value2,...);
Inputs = mbcmodel.modelinput(NUMINPUTS);
Inputs = mbcmodel.modelinput(INPUTCELLARRAY);
```

Description   This is the constructor for the mbcmodel.modelinput object.

```
Inputs =
mbcmodel.modelinput('PropertyName1',value1,'PropertyName2',value2,...);
```

You can set the properties shown in the following table.

Property	Description
Range	[min,max]
NonlinearTransform	{'','1./x','sqrt(x)', 'log10(x)','x.^2', 'log(x)'}
Name	String. Signal name from data set. Inputs for a test plan must be set before selecting data.
Symbol	String. Short name for plot labels and for use in CAGE.
Units	String. Units are overwritten from the data set units when a data is selected.

Specify "property, value" pairs as follows:

```
Inputs = mbcmodel.modelinput('Symbol',{'A','B'},...
  'Range',{[0 100],[-20 20]});
```

Scalar expansion of properties is supported, e.g.,

```
Inputs = mbcmodel.modelinput('Symbol',{'A','B'},...
```

```
  'Range',[0 100]);
```

```
Inputs = mbcmodel.modelinput(NUMINPUTS);
```

NUMINPUTS is the number of inputs. Symbols are automatically set to
`'X1'`, `'X2'`,...,`'Xn'`. The default range is [-1,1]. For example:

```
  Inputs = mbcmodel.modelinput(2);
```

```
Inputs = mbcmodel.modelinput(INPUTCELLARRAY);
```

INPUTCELLARRAY is a cell array with one row per input and 5 columns
to specify factor names, symbols, ranges and nonlinear transforms as
follows.

The columns of INPUTCELLARRAY must be:

1 Factor symbol (string)

2 Minimum (double)

3 Maximum (double)

4 Transform (string) — empty for none

5 Signal name

These columns are the same as the columns in the Model Factor Setup
dialog box, which can be launched from the test plan in the model
browser.

Examples   To create a modelinput object with 2 inputs, enter:

```
  Inputs = mbcmodel.modelinput(2);
```

To create a modelinput object and define symbols and ranges, enter:

```
  Inputs = mbcmodel.modelinput('Symbol',{'A','B'},...
   'Range',{[0 100],[-20 20]});
```

```
Inputs = mbcmodel.modelinput('Symbol',{'A','B'},...
 'Range',[O 100]);
```

To create a modelinput object and define inputs with a cell array, enter:

```
Inputs = mbcmodel.modelinput( {...
 'N',   800, 5000, '', 'ENGSPEED'
 'L',   0.1,    1, '', 'LOAD'
'EXH',  -5,    50, '', 'EXHCAM'
'INT',  -5,    50, '', 'INTCAM'} );
```

See Also   CreateModel, CreateTestplan

Purpose   Open Model Setup dialog box where you can alter model type

Syntax   [newModel, OK] = ModelSetup(oldModel)

Description   This is a method of mbcmodel.model objects.

This method opens the **Model Setup** dialog box where you can choose new model types and settings. If you click **Cancel** to dismiss the dialog, OK = false and newModel = oldModel. If you click **OK** to close the dialog box, then OK = true and newModel is your new chosen model setup. Data and response remain the same as oldModel. The new model is refitted when you click OK.

Call UpdateResponse to put the new model type back into the response.

Examples   [RBF, OK] = ModelSetup(Cubic);

See Also   UpdateResponse, Fit

Modified

Purpose	Boolean signaling whether project has been modified
Syntax	`Name = P.Modified`
Description	This is a property of `mbcmodel.project`.
Examples	`Name = Project.Modified;`

Purpose   Modify user-defined filter in data set

Syntax   D = ModifyFilter(D, Index, expr)

Description This is a method of mbcmodel.data.

You call this method to modify the expression that defines existing filters.

D is a data object.

Index is the input index to indicate which of the available filters you wish to modify. Use the property Filters to find the index for each filter.

expr is the input string holding the expression that defines the filter, as for AddFilter.

Examples   ModifyFilter(D, 3, 'AFR < AFR_CALC + 20');

The effect of this filter is to modify filter number 3 to keep all records where AFR < AFR_CALC + 20.

    ModifyFilter(D, 2, 'MyNewFilterFunction(AFR, RPM, TQ, SPK)');

This modifies filter number 2 to apply the function MyNewFilterFunction.

See Also   AddFilter, RemoveFilter, Filters

ModifyTestFilter

Purpose	Modify user-defined test filter in data set
Syntax	`D = ModifyTestFilter(D, Index, expr)`
Description	This is a method of `mbcmodel.data`.
	You call this method to modify the expression that defines existing filters.
	`D` is a data object.
	`Index` is the input index to indicate which of the available test filters you wish to modify. Use the property `TestFilters` to find the index for each test filter.
	`expr` is the input string holding the expression that defines the test filter, as for `AddTestFilter`.
Examples	`ModifyTestFilter(d1, 2, 'any(n>2000)');`
	The effect of this is to modify test filter number 2 to include all tests in which any records have speed (n) greater than 1000.
See Also	`AddTestFilter`, `RemoveTestFilter`, `TestFilters`

ModifyVariable

Purpose　　　Modify user-defined variable in data set

Syntax　　　`D = ModifyVariable(D, Index, expr, units)`

Description　　This is a method of `mbcmodel.data`.

You call this method to modify the expression that defines existing variables.

`D` is a data object.

`Index` is the input index to indicate which of the available variables you wish to modify. Use the property `UserVariables` to find the index for each variable.

`expr` is the input string holding the expression that defines the variable, as for `AddVariable`

`units` is an optional input string holding the units of the variable

Examples　　　`ModifyVariable(D, 2, 'MY_NEW_VARIABLE = TQ*AFR/2');`

See Also　　　`AddVariable`, `RemoveVariable`, `UserVariables`

MultipleVIF

Purpose	Multiple VIF matrix for linear model parameters
Syntax	`VIF = MultipleVIF(LINEARMODEL)`
Description	This is a method of `mbcmodel.linearmodel`.
	`VIF = MultipleVIF(LINEARMODEL)` calculates the multiple Variance Inflation Factor (VIF) matrix for the linear model parameters.
Examples	`VIF = MultipleVIF(knot_model)`
See Also	`ParameterStatistics`

Purpose   Name of project, data, test plan, input, or model objects

Syntax   `name = A.Name`

Description   This is a property of project, data, test plan, input, and model objects.

A can be any test plan (`T`), data (`D`), project (`P`) or model (`L`, `R`, `HR`) object.

You can change the names of these objects (except data objects) as follows:

    A.Name = newName

For response (output or Y data) signal names, see `ResponseSignalName`.

For `mbcmodel.model.Name`, the Name property refers to the model output name. This property is set to the data signal name when the response is created or if a model is assigned to a response. This property cannot be set when a response is attached to the model.

For model parameter names, see `Names`, and for model object input names, see `XDataNames`.

For testplan and response object input names, see `InputSignalNames`, and for data objects, see `SignalNames`.

Examples   `ResponseFeatureName = thisRF.Name;`

See Also   `Names`, `InputSignalNames`, `SignalNames`, `XDataNames`, `ResponseSignalName`

Names

Purpose	Model parameter names
Syntax	`N = params.Names`
Description	This is a property of `mbcmodel.modelparameters`. It returns the names of all the parameters in the model. These are read-only.

Examples

```
N = paramsknot.Names
N =
'1'
'N'
'N^2'
'N*L'
'N*A'
'L'
'L^2'
'L*A'
'A'
'A^2';
```

See Also `NumberOfParameters`, `Values`, `Name`

Purpose   Create new project file

Syntax   `P = New(P)`

Description   This is a method of `mbcmodel.project`. Use this to modify a project object to make a new project from scratch. Note the current project gets removed from memory when you open a new one.

P is the new project object.

Examples   `New(P);`

See Also   `Load`

NumberOfInputs

Purpose   Number of model inputs

Syntax   N = model.NumberOfInputs

Description This is a property of `mbcmodel.model`. It returns the number of inputs
                 to the model.

Examples   N = knot.'NumberOfInputs;

See Also   XData

Purpose   Number of included model parameters

Syntax   N = knotparams.NumberOfParameters

Description   This is a read-only property of mbcmodel.linearmodelparameters, for linear models only.

The number returned is the number of parameters currently in the model (you can remove some parameters by using StepwiseRegression). To see which parameters are currently in the model, use StepwiseSelection. Only parameters listed as 'in' are currently included.

To see the the total possible number of parameters in a linear model, use SizeOfParameterSet.

Use Names and Values to get the parameter names and values.

Examples   N = knotparams.NumberOfParameters;

See Also   SizeOfParameterSet, StepwiseSelection, StepwiseRegression, Names, Values

NumberOfRecords

Purpose　　　Total number of records in data object

Syntax　　　numRecords = D.NumberOfRecords

Description　This is a property of data objects: `mbcmodel.data`.

Examples　　numRecords = Data.NumberOfRecords;

Purpose   Total number of tests being used in model

Syntax   numtests = A.NumberOfTests

Description   This is a property of all model objects:
mbcmodel.hierarchicalresponse, mbcmodel.localresponse and
mbcmodel.response, and data objects mbcmodel.data. 'A' can be any
model or data object.

Examples   numTests = TQ_response.NumberOfTests;

See Also   DefineTestGroups

OutlierIndices

Purpose	Indices of `DoubleInputData` marked as outliers
Syntax	`indices = OutlierIndices(R)`
Description	This is a method of all model objects: `mbcmodel.hierarchicalresponse`, `mbcmodel.localresponse` and `mbcmodel.response`.
Examples	`ind = OutlierIndices(R);` `bad = OutlierIndices(thisRF);`
See Also	`DoubleInputData`

Purpose   Indices marked as outliers for test

Syntax   indices = OutlierIndicesForTest(R, TestNumber)

Description This is a method of the local model object, mbcmodel.localresponse.

This shows the current records discarded as outliers.

You can use ':' to use all tests.

Examples
```
ind = OutlierIndicesForTest(R, ':');
bad = OutlierIndicesForTest(local, tn);
```

See Also   OutlierIndices

OutputData

Purpose	Output (or response) data for model
Syntax	D = M.OutputData
Description	This is a property of mbcmodel.model. It returns an array of the response data currently in the model.
Examples	D = knot.OutputData;
See Also	InputData

Purpose   Object from which data was received

Syntax   O = D1.Owner

Description   This is a property of mbcmodel.data.

- This is empty if the data was created using mbcmodel.CreateData
- This is an mbcmodel.project object if the data was extracted from a project
- This is an mbcmodel.testplan object if the data was extracted from a test plan

Examples   O = D1.Owner;

Parameters

Purpose	Model parameters
Syntax	`P = model.Parameters`
Description	This is a property of `mbcmodel.model.`, that contains an object `mbcmodel.modelparameters`. This object contains a number of read-only parameters that describe the model.

All models have these properties:

- `SizeOfParameterSet`
- `Names`
- `Values`

Linear models also have these properties:

- `StepwiseStatus`
- `NumberOfParameters`
- `StepwiseSelection`

Radial Basis Function (RBF) models have all the above properties and these additional properties:

- `Centers`
- `Widths`

Examples
```
P = model.Parameters;
```

See Also `SizeOfParameterSet, Names, Values, StepwiseStatus, NumberOfParameters, StepwiseSelection, Centers, Widths`

Purpose   Calculate parameter statistics for linear model

Syntax   values = ParameterStatistics(linearmodel, optional statType)

Description   This is a method of mbcmodel.model, for linear models only. This
calculates parameter statistics for the linear model. If you don't specify
statType, then a structure with all valid types is output. statType
may be a string specifying a particular statistic or a cell array of string
specifying a number of statistics to output. If statType is a string, then
values is an array of doubles. If statType is a cell array of strings,
then values is a cell array of array of doubles.

The valid types are:

'Alias'

'Covariance'

'Correlation'

'VIFsingle'

'VIFmultiple'

'VIFpartial'

'Stepwise'

These types (except Stepwise) appear in the Design Evaluation tool; see
the documentation for this tool for details of these matrices.

The Stepwise field contains the values found in the Stepwise table. In
this array (and in the Stepwise GUI) you can see for each parameter
in the model: the value of the coefficient, the standard error of the
coefficient, the t value and Next PRESS (the value of PRESS if
the status of this term is changed at the next iteration). See the
documentation for the Stepwise table. You can also see these Stepwise
values when you use StepwiseRegression.

Examples
```
values = ParameterStatistics(knot)
values =
```

ParameterStatistics

```
              Alias: [7x3 double]
         Covariance: [7x7 double]
        Correlation: [7x7 double]
          VIFsingle: [5x5 double]
        VIFmultiple: [7x1 double]
         VIFpartial: [5x5 double]
            Stepwise: [10x4 double]

values.Stepwise
ans =
  1.0e+003 *
     0.0190    0.0079    0.0210       NaN
     0.0000    0.0000    0.0210    1.9801
     0.0000    0.0000    0.0200    0.2984
    -0.0000    0.0000    0.0200    0.2768
     0.0000    0.0000    0.0200    0.2890
    -0.0526    0.0367    0.0210    0.2679
     0.0911    0.0279    0.0210    0.3837
    -0.0041    0.0024    0.0210    0.2728
    -0.0178    0.0095    0.0200    0.2460
     0.0001    0.0000    0.0210    0.3246
```

See Also   StepwiseRegression

Purpose   Partial VIF matrix for linear model parameters

Syntax   STATS = PartialVIF(LINEARMODEL)

Description   This is a method of mbcmodel.linearmodel.

STATS = PartialVIF(LINEARMODEL) calculates the partial Variance Inflation Factor (VIF) matrix for the linear model parameters.

Examples   VIF = PartialVIF(knot_model)

See Also   ParameterStatistics

PEV

Purpose	Predicted error variance of model at specified inputs
Syntax	`pev = PEV(R, X)`

Description   This is a method of the hierarchical, local response, response, and model objects: mbcmodel.hierarchicalresponse, mbcmodel.response, and mbcmodel.model.

R is the model object, and X is the array of input values where you want to evaluate the PEV of the model. For a local response, the predicted value uses the hierarchical model.

Note that for an mbcmodel.model and mbcmodel.response objects only, the X is optional. That is, the syntax is:

```
PEV = PEV(model, optional X)
```

This calculates the Predicated Error Variance at X. If X is not specified, then X is the existing input values. An array is returned of PEV values evaluated at each data point.

Examples   `pev = PEV(R, X);`

See Also   PEVForTest

Purpose   Local model predicted error variance for test

Syntax   pev = PEVforTest(L, TestNumber, X)

Description   This is a method of the local model object, mbcmodel.localresponse.

L is the local model object.

TestNumber is the test for which you want to evaluate the model PEV.

X is the array of inputs where you want to evaluate the PEV of the model.

Examples   pev = PEVforTest(L, TestNumber, X);

See Also   PEV

PredictedValue

Purpose Predicted value of model at specified inputs

Syntax
```
y = PredictedValue(R,X)
y = PredictedValue(R)
```

Description This is a method of the hierarchical, response, local response, and model objects: `mbcmodel.hierarchicalresponse`, `mbcmodel.response`, `mbcmodel.localresponse`, and `mbcmodel.model`.

`y = PredictedValue(R,X)` evaluates the model at the specified inputs, where `R` is the model object, and `X` is the array of inputs where you want to evaluate the output of the model.

Note that for an `mbcmodel.model`, `mbcmodel.localresponse` and `mbcmodel.response` objects, the X is optional. If X is not specified then the X is the existing input values. That is, the syntax is:

```
y = PredictedValue(model, optional X)
```

`y = PredictedValue(R)` calculates the predicted value at the fit data. An array is returned of predicted values evaluated at each data point. For local models, this is equivalent to `y= PredictedValue(L, L.InputData)`

Note that you cannot evaluate model output for a local response or hierarchical response until you have constructed it using `MakeHierarchicalResponse` (or `CreateAlternativeModels`). If you have created alternative response feature models then a best model must be selected. If you have made changes such as removing outliers since choosing a model as best, you may need to choose a new best model. For a local response, the predicted value uses the hierarchical model. If no data is specified then the data from all tests is used.

Examples
```
y = PredictedValue(R, X);
modelPred = PredictedValue(thisRF, x);
```

See Also `PredictedValueForTest`, `ChooseAsBest`, `PEV`, `Evaluate`

Purpose   Predicted local model response for test

Syntax   `y = PredictedValueForTest(L, TestNumber, X)`

Description   This is a method of the local model object, `mbcmodel.localresponse`.

L is a local model object.

TestNumber is the test for which you want to evaluate the model

X is the array of inputs where you want to evaluate the output of the model.

Examples   `y = PredictedValueForTest(L, TestNumber, X);`

See Also   `PredictedValue`

Properties

Purpose   View and edit model properties

Syntax   ```
properties=M.Properties
M.Properties.PropertyName = NewValue
M.Properties.properties
f=M.Properties.properties
```

**Description**     "Properties" is a property of mbcmodel.model

properties=M.Properties returns a mbcmodel.modelproperties
object.

To edit a property, use the syntax M.Properties.PropertyName =
NewValue

"properties" is a method of mbcmodel.fitalgorithm and
mbcmodel.modelproperties which returns a list of properties.

M.Properties.properties lists the property names, types and allowed
values.

f=M.Properties.properties returns the property names as a cell
array.

The model Type determines which properties you can set (see ).

To get a mbcmodel.modelproperties object from a model:

```
>> M = mbcmodel.CreateModel('Polynomial', 4);
>> disp(M)
mbcmodel.linearmodel:Polynomial

>>modelproperties=M.Properties

modelproperties =
Polynomial Properties
                Order: [3 3 3 3]
      InteractionOrder: 3
    TransformInputRange: 1
         ParameterNames: {35x1 cell}
```

```
           StepwiseStatus: {35x1 cell}
                   BoxCox: 1
```

To create a model and list the properties:

```
>> M = mbcmodel.CreateModel('RBF',2)

M =

    A radial basis function network using a multiquadric kernel
      with O centers
    and a global width of 2.
    The regularization parameter, lambda, is 0.0001.
    InputData: [0x2 double]
    OutputData: [0x1 double]
    Status: Not fitted
    Linked to Response: <not linked>

>> M.Properties.properties
RBF Properties
    Kernel: RBF kernel (enum: {'multiquadric',...
'recmultiquadric','gaussian','thinplate','logisticrbf',...
'wendland', 'linearrbf','cubicrbf'})
    Continuity: Continuity for Wendland kernel...
 (0,2,4,6,8) (int: [0,8])
    ParameterNames: List of parameter names (read-only)
    StepwiseStatus: Stepwise status {'Always','Never',...
'Step'} (cell)
    BoxCox: Box-Cox transform (power) (numeric: [-3,3])
```

The following syntax returns the properties as a cell array:

```
>> f=M.Properties.properties

f =

    'Kernel'
    'Continuity'
```

Properties

```
'ParameterNames'
'StepwiseStatus'
'BoxCox'
```

Change a property as follows:

```
>>M.Properties.Kernel = 'thinplate';
```

The model changes state to 'Being Edited'. The settings are not applied until you call Fit on the model object.

The following sections list the properties available for each model type.

Linear Models — Polynomial Properties

mbcmodel.linearmodel:Polynomial

Order: Polynomial order (vector int: {[0,Inf],2})

InteractionOrder: Maximum order of interaction terms (int: [0,Inf])

TransformInputRange: Transform inputs (Boolean)

ParameterNames: List of parameter names (read-only)

StepwiseStatus: Stepwise status {'Always','Never','Step'} (cell)

BoxCox: Box-Cox transform (power) (numeric: [-3,3])

Linear Models — Hybrid Spline Properties

mbcmodel.linearmodel:Hybrid Spline

Order: Spline and polynomial order (vector int: {[0,3],2})

SplineVariable: Spline variable

SplineInteraction: Order of interaction between spline and polynomial (int: [0,3])

Knots: Position of knots (vector real)

ParameterNames: List of parameter names (read-only)

StepwiseStatus: Stepwise status {'Always','Never','Step'} (cell)

BoxCox: Box-Cox transform (power) (numeric: [-3,3])

Linear Models — RBF Properties

mbcmodel.linearmodel:RBF

Kernel: RBF kernel (enum: {'multiquadric','recmultiquadric','gaussian','thinplate','logisticrbf','wendland', 'linearrbf','cubicrbf'})

Continuity: Continuity for Wendland kernel (0,2,4,6,8) (int: [0,8])

ParameterNames: List of parameter names (read-only)

StepwiseStatus: Stepwise status {'Always','Never','Step'} (cell)

BoxCox: Box-Cox transform (power) (numeric: [-3,3])

Linear Models — Polynomial-RBF Properties

mbcmodel.linearmodel:Polynomial-RBF

Order: Polynomial order (vector int: {[0,Inf],2})

InteractionOrder: Maximum order of interaction terms (int: [0,Inf])

Kernel: RBF kernel (enum:

{'multiquadric','recmultiquadric','gaussian','thinplate','logisticrbf','wendland', 'linearrbf','cubicrbf'})

Continuity: Continuity for Wendland kernel (0,2,4,6,8) (int: [0,8])

ParameterNames: List of parameter names (read-only)

StepwiseStatus: Stepwise status {'Always','Never','Step'} (cell)

BoxCox: Box-Cox transform (power) (numeric: [-3,3])

Linear Models — Hybrid Spline-RBF Properties

mbcmodel.linearmodel:Hybrid Spline-RBF

Order: Spline and polynomial order (vector int: {[0,3],2})

SplineVariable: Spline variable

Properties

SplineInteraction: Order of interaction between spline and polynomial (int: [0,3])

Knots: Position of knots (vector real)

Kernel: RBF kernel (enum: {'multiquadric','recmultiquadric','gaussian','thinplate','logisticrbf','wendland', 'linearrbf','cubicrbf'})

Continuity: Continuity for Wendland kernel (0,2,4,6,8) (int: [0,8])

ParameterNames: List of parameter names (read-only)

StepwiseStatus: Stepwise status {'Always','Never','Step'} (cell)

BoxCox: Box-Cox transform (power) (numeric: [-3,3])

Nonlinear Models — Free Knot Spline Properties

mbcmodel.model:Free Knot Spline

Order: Spline order (int: [0,3])

NumKnots: Number of knots (int: 'Positive')

Nonlinear Models — Neural Network Properties

mbcmodel.model:Neural Network

HiddenLayers: Number of hidden layers (int: [1,2])

Neurons: Number of Neurons in each hidden layer (vector int: 'Positive')

Examples

```
>> properties=M.Properties

properties =
Polynomial Properties
                    Order: [3 3 3 3]
         InteractionOrder: 3
     TransformInputRange: 1
           ParameterNames: {35x1 cell}
           StepwiseStatus: {35x1 cell}
                   BoxCox: 1
```

```
>> M.Properties.Order = [3 2 2 3]

M =

  1 + 2*X1 + 10*X4 + 15*X2 + 18*X3 + 3*X1^2 + 6*X1*X4
...+ 8*X1*X2 + 9*X1*X3 +
  11*X4^2 + 13*X4*X2 + 14*X4*X3 + 16*X2^2 + 17*X2*X3
...+ 19*X3^2 + 4*X1^3 +
  5*X1^2*X4 + 7*X1*X4^2 + 12*X4^3
  InputData: [0x4 double]
  OutputData: [0x1 double]
  Status: Being Edited
  Linked to Response: <not linked>
```

See Also   Type, LocalModel Properties

RecordsPerTest

Purpose   Number of records in each test

Syntax   `numRecords = D.RecordsPerTest`

Description   This is a property of data objects: `mbcmodel.data`. It returns an array, of length `NumberOfTests`, containing the number of records in each test.

Examples   `numRecords = D.RecordsPerTest;`

Purpose   Remove project, test plan, or model

Syntax   `OK = Remove(A)`

Description This is a method of all the non-data objects: projects, test plans and all models.

A can be any project, test plan or model object.

Datum models cannot be removed if they are in use by other models.

Examples   `OK = Remove(R3);`

RemoveData

Purpose	Remove data from project
Syntax	P = RemoveData(P, D) P = RemoveData(P, Index)
Description	This is a method of mbcmodel.project. You can refer to the data object either by name or index. P is the project object. D is the data object you want to remove. Index is the index of the data object you want to remove.
Examples	RemoveData(P, D);
See Also	CreateData, Data, CopyData

Purpose   Remove user-defined filter from data set

Syntax   D = RemoveFilter(D, Index)

Description   This is a method of the mbcmodel.data object.

                   Index is the input index indicating the filter to remove. Use the
                   property Filters to find out which filters are present.

Examples   RemoveFilter(D1, 3);

See Also   AddFilter, Filters

RemoveOutliers

Purpose   Remove outliers in input data by index or rule, and refit models

Syntax
```
R = RemoveOutliers(R, Selection);
R = RemoveOutliers(L, LocalSelection, GlobalSelection)
```

Description   This is a method of the local model object, `mbcmodel.localresponse` and the response feature model object `mbcmodel.response`.

All the response feature models are refitted after the local models are refitted. Outlier selection is applied to all tests.

For a response model:

- `R` is a response object
- `Selection` specifies either a set of indices or the name of an outlier selection function, of the following form:

  ```
  Indices = myMfile(model, data, factorName)
  ```

  The factors are the same as defined in `DiagnosticStatistics`

- `data` contains the factors as columns of a matrix
- `factorNames` is a cell array of the names for each factor

For a local model:

- `LocalSelection` is the local outlier selection indices or function
- `GlobalSelection` is the global outlier selection indices or function

  Outlier selection functions must conform to this prototype:

  ```
  Indices = myMfile(model, data, factorName)
  ```

  The factors are the same as appear in the scatter plot in the Model Browser.

- `data` contains the factors as columns of a matrix

- factorNames is a cell array of the names for each factor

Examples
```
outlierind = [1 4 6 7];
RemoveOutliers(thisRF, outlierind);
```

See Also   RemoveOutliersForTest

RemoveOutliersForTest

Purpose   Remove outliers on test by index or rule and refit models

Syntax
```
L = RemoveOutliersForTest(LOCALRESPONSE, TESTNUMBER,
    LOCALSELECTION)
L = RemoveOutliersForTest(LOCALRESPONSE, TESTNUMBER,
    LOCALSELECTION, doUpdate)
```

Description   This is a method of mbcmodel.localresponse.

L = RemoveOutliersForTest(LOCALRESPONSE, TESTNUMBER, LOCALSELECTION) removes outliers, refits the local model, and refits the response feature models.

L = RemoveOutliersForTest(LOCALRESPONSE, TESTNUMBER, LOCALSELECTION, doUpdate) removes outliers and if doUpdate is true, refits all response features after the local model is refitted.

TESTNUMBER is the single test number to refit.

LOCALSELECTION can either be a set of indices or a function name.

An outlier selection function must take the following form:

```
INDICES = MYMFILE(MODEL, DATA, FACTORNAME);
```

The factors are the same as defined in DiagnosticStatistics.

DATA contains the factors as columns of a matrix, and FACTORNAME is a cell array of the names for each factor.

Examples   For a local response LOCALRESPONSE, to remove first two data points and do not update response features:

```
RemoveOutliersForTest(LOCALRESPONSE,1,1:2,false);
```

To find list of indices of removed data points:

```
indices = OutliersForTest(LOCALRESPONSE,1);
```

To restore first data point:

```
RestoreDataForTest(LOCALRESPONSE,1,1,false);
```

To restore all data:

```
RestoreDataForTest(LOCALRESPONSE,1,':',false);
```

To update response features:

```
UpdateResponseFeatures(LOCALRESPONSE);
```

See Also   UpdateResponseFeatures, RestoreDataForTest,
OutlierIndicesForTest, RemoveOutliers

RemoveTestFilter

Purpose   Remove user-defined test filter from data set

Syntax   `D = RemoveTestFilter(D, Index)`

Description   This is a method of `mbcmodel.data`.

D is the data object.

`Index` is the input index indicating the filter to remove.

Use the property `TestFilters` to find the index of the test filter you want to remove.

Examples   `RemoveTestFilter(D1, 2);`

See Also   `AddTestFilter`, `TestFilters`

Purpose　　　Remove user-defined variable from data set

Syntax　　　　`D = RemoveVariable(D, Index)`

Description　　This is a method of `mbcmodel.data`.

`D` is the data object.

`Index` is the input index indicating the variable to remove.

Use `UserVariables` to find the index of the variable you want to remove.

Examples　　　`RemoveVariable(D1, 2);`

See Also　　　`AddVariable`, `UserVariables`

Response

Purpose	Response for model object
Syntax	R = model.Response
Description	This is a property of `mbcmodel.model`. It returns the response the model object came from (e.g. a response object).
	If you make changes to the model object (for example by changing the model type using ModelSetup, or using StepwiseRegression) you must use UpdateResponse to return the new model object to the response in the project.
Examples	R = model.Response;
See Also	UpdateResponse, ModelSetup

ResponseFeatures(Local Model)

Purpose   Set of response features for local model

Syntax   RFs = L.ResponseFeatures

Description This is a property of the local model object, `mbcmodel.localmodel`.

RFs = L.ResponseFeatures returns a `mbcmodel.responsefeatures` object. `L` is the local model.

See "Understanding Model Structure" in the Getting Started documentation for an explanation of the relationships between local models, local responses, and other responses.

Available properties and methods are described in the following tables.

Property	Description
EvaluationPoints	Cell array of evaluation points for the response feature set (read-only). An element of EvaluationPoints is empty if the response feature does not use the Evaluation point. This property is set up when the response feature is created (see the Add method).
Types	Cell array of types for response feature set (read-only). This property is set up when the response feature is created (see the Add method).
NumberOfResponseFeatures	Number of response features in set (read-only).
IsFitted	The local model has been fitted.

ResponseFeatures(Local Model)

Method	Description

Add	Add new response feature to response feature set
	
	   `RF = Add(RF,RFtype)`
	
	RFtype is a description string belonging to the set of alternative response features. See getAlternativeTypes.
	
	   `RF = Add(RF,RFtype,EvaluationPoint)`
	
	EvaluationPoint is a row vector with an element for each model input and is used for response features that require an input value to evaluate the response feature (e.g., function evaluation, derivatives). It is an error to specify an evaluation point for a response feature type that does not require an evaluation point.

Remove	Remove a response feature from the response feature set `RF = Remove(RF,index)`
Select	Select a subset of response features from the response feature set `RF = Select(RF,indices)`
getDefaultSet	List of default response features `RF = getDefaultSet(RF)` Returns an mbcmodel.responsefeatures object with the default set of response features for the local model.

Method	Description
getAlternativeTypes	List of all alternative response feature types for local model ```RFtypes = getAlternativeTypes(RF)``` Returns a cell array of response feature type strings for the local model.

Evaluate	Evaluate response features
	
	```rfvals = Evaluate(RF);```
	
	Returns the values for the response features for the current local model.
	
	```[rfvals,stderr] = Evaluate(RF)```
	
	Also returns the standard errors for the response features for the current local model. The local model must be fitted before evaluating response features.

Jacobian	Jacobian matrix of response features with respect to parameters ```J = Jacobian(RF)``` The local model must be fitted before calculating the Jacobian matrix.
Covariance	Covariance matrix for response features ```rfvals = Covariance(RF);``` The local model must be fitted before calculating the covariance matrix.

ResponseFeatures(Local Model)

Method	Description
Correlation	Correlation matrix for response features `rfvals = Correlation(RF)` Errors occur if model is not fitted.
ReconstructSets	List of subsets of response features which can be used to reconstruct the local model `RFlist = ReconstructSets(RF)` RFlist is a cell array of mbcmodel.responsefeatures. Each element of RFlist can be used to reconstruct the local model from response feature values.

Examples   First, create a local model object:

```
L = mbcmodel.CreateModel('Local Polynomial',2)


L =

   1 + 2*X1 + 8*X2 + 3*X1^2 + 6*X1*X2 + 9*X2^2 + 4*X1^3...
 + 5*X1^2*X2 + 7*X1*X2^2 +
   10*X2^3
   InputData: [0x2 double]
   OutputData: [0x1 double]
   Status: Not fitted
   Linked to Response: not linked
```

The properties of the local model object are the same as the properties of an mbcmodel.model object with the additional property "ResponseFeatures". Look at the response features property as follows:

```
>> RFs = L.ResponseFeatures

RFs =

Response features for Polynomial
    'Beta_1'
    'Beta_X1'
    'Beta_X1^2'
    'Beta_X1^3'
    'Beta_X1^2*X2'
    'Beta_X1*X2'
    'Beta_X1*X2^2'
    'Beta_X2'
    'Beta_X2^2'
    'Beta_X2^3'

% Set up response features
RFtypes = getAlternativeTypes(RFs);
RF = Add(RF, RFtypes{end},-10);

% assign to local model
L.ResponseFeatures = RFs;
```

ResponseFeatures(Local Response)

Purpose   Array of response features for local response

Syntax   `RFs = L.ResponseFeatures`

Description   This is a property of the local model object, `mbcmodel.localresponse`.

L is the local response.

See "Understanding Model Structure" in the Getting Started documentation for an explanation of the relationships between local responses and other responses.

Examples   `RFs = Local.ResponseFeatures;`

Purpose   Name of signal or response feature being modeled

Syntax   ysignal = R.ResponseSignalName

Description   This is a property of all response objects:
                   mbcmodel.hierarchicalresponse, mbcmodel.localresponse and
                   mbcmodel.response.

                   R can be a hierarchical response, local response or response.

Examples   yName = local.ResponseSignalName;

See Also   InputSignalNames

Responses

Purpose	Array of available responses for test plan
Syntax	R = T.Responses
Description	This is a property of mbcmodel.testplan.
	T is the test plan object.
	See "Understanding Model Structure" for an explanation of the relationship between test plans and responses.
Examples	R = T.Responses;

Purpose   Restore removed outliers

Syntax   R = RestoreData(RESPONSE)
                  R = RestoreData(RESPONSE, OUTLIERINDICES)

Description   This is a method of mbcmodel.localresponse and mbcmodel.response.

                  R = RestoreData(RESPONSE) restores all data previously removed as
                  outliers.

                  R = RestoreData(RESPONSE, OUTLIERINDICES) restores all removed
                  data specified in OutlierIndices. For a local response, the indices
                  refer to record numbers for all tests.

Examples   RemoveOutliers(R, 1:5)
                      RestoreData(R, 1:2)

See Also   RemoveOutliersForTest, RemoveOutliers, OutlierIndices

RestoreDataForTest

Purpose   Restore removed outliers for test

Syntax   L = RestoreDataForTest(LOCALRESPONSE, TESTNUMBER, Indices)
                   L = RestoreDataForTest(LOCALRESPONSE, TESTNUMBER, Indices,
                     doUpdate)

Description   This is a method of mbcmodel.localresponse.

                   L = RestoreDataForTest(LOCALRESPONSE, TESTNUMBER, Indices)
                   restores all removed data for TESTNUMBER specified in Indices.

                   L = RestoreDataForTest(LOCALRESPONSE, TESTNUMBER, Indices,
                   doUpdate) restores all specified removed data and if doUpdate is true,
                   refits all response features. By default, all response feature models will
                   be updated. If a number of tests are being screened it is more efficient
                   to set doUpdate to false and call UpdateResponseFeatures when all
                   the tests have been screened.

                   Indices must be numbers and must belong to the set of outliers in
                   OutliersForTest.

Examples   For a local response LOCALRESPONSE, to remove first two data points
                   without updating response features:

                       RemoveOutliersForTest(LOCALRESPONSE,1,1:2,false);

                   To find list of indices of removed data points:

                       indices = OutliersForTest(LOCALRESPONSE,1);

                   To restore first data point:

                       RestoreDataForTest(LOCALRESPONSE,1,1,false);

                   To restore all data:

                       RestoreDataForTest(LOCALRESPONSE,1,':',false);

                   To update response features:

```
UpdateResponseFeatures(LOCALRESPONSE);
```

See Also   UpdateResponseFeatures, RemoveOutliersForTest, OutlierIndicesForTest

RollbackEdit

Purpose   Undo most recent changes to data

Syntax   `D = RollbackEdit(D)`

Description   This is a method of `mbcmodel.data`. Use this if you change your mind
                     about changes you have made to the data since you called `BeginEdit`,
                     such as importing or appending data, applying filters or creating new
                     user variables.

                     There are no input arguments. If for your data object `D`, `IsBeingEdited`
                     is `true`, then `RollbackEdit` will return it to the same state as it was
                     when `BeginEdit` was called. If `IsEditable(D)` is `true` then you can still
                     modify it, if not it will revert to being read-only. See the example below.

Examples
```
D = P.Data;
BeginEdit(D);
AddVariable(D, 'TQ = tq', 'lbft');
AddFilter(D, 'TQ < 200');
DefineTestGroups(D, {'RPM' 'AFR'}, [50 10], 'MyLogNo');
RollbackEdit(D);
```

This returns the data object `D` to the same state as when `BeginEdit` was
called. If the data object `IsEditable` then the returned object will still
return true for `IsBeingEdited`, else it will not be editable.

For an example case where `IsEditable` is `false` and `IsBeingEdited`
is `true`:

```
D = p.Data;
D1 = p.Data;
BeginEdit(D1);
tp = p.Testplan;
Attach(tp, D);
```

Where `p` is an `mbcmodel.project` object, and `D` and `D1` are
`mbcmodel.data` objects.

At this point IsEditable for D1 becomes false because it is now Attached to the test plan and hence can only be modified from the test plan. However

```
OK = D1.IsBeingEdited
```

will still be true at this point, and trying to call CommitEdit will fail.

See Also   BeginEdit, CommitEdit, IsBeingEdited

Save

Purpose	Save project to currently selected filename
Syntax	`OK = Save(P, Name)`
Description	This is a method of `mbcmodel.project`.
Examples	`OK = Save(proj, 'Example.mat');`
See Also	`SaveAs`

Purpose   Save project to new file

Syntax   OK = SaveAs(P, Name)

Description   This is a method of mbcmodel.project.

Examples   OK = SaveAs(proj, 'Example.mat');

See Also   Save

SetTermStatus

Purpose   Set status of model terms

Syntax   `M.Properties = M.Properties.SetTermStatus(Terms, Status)`

Description   This is a method of `mbcmodel.linearmodelproperties`.

`M.Properties = M.Properties.SetTermStatus(Terms, Status)` sets the status of the specified terms in this model. `Status` must be a cell array of status strings.

The stepwise status for each term can be Always, Never or Step. The status determines whether you can use the StepwiseRegression function to throw away terms in order to try to improve the predictive power of the model.

`M` is an `mbcmodel.linearmodel` object.

Examples
```
M = mbcmodel.CreateModel('Polynomial', 2);
M.Properties = M.Properties.SetTermStatus([1 2; 1 0],
 {'Never',  'Always'});
```

This example sets the status of the `X1*X2^2` term to `Never` and the `X1` term to `Always`.

See Also   `GetTermStatus`, `StepwiseStatus`

Purpose	Open fit algorithm setup dialog box
Syntax	`[OPT,OK]= SetupDialog(F)`
Description	This is a method of `mbcmodel.fitalgorithm`.
	`[OPT,OK]= SetupDialog(F)` opens the fit algorithm setup dialog box, where you can edit the algorithm parameters. `F` is a `mbcmodel.fitalgorithm` object.
	If you click **Cancel** to dismiss the dialog, `OK = false` and no changes are made. If you click **OK** to close the dialog box, then `OK = true` and your new chosen algorithm parameters are set up.
Examples	`[OPT,OK]= SetupDialog(F)`
See Also	`CreateAlgorithm`, `getAlternativeNames`

SignalNames

Purpose	Names of signals held by data
Syntax	names = D.SignalNames
Description	This is a property of mbcmodel.data.
	This is a cell array of strings that hold the names of the signals within the data. These names can be used to reference the appropriate signals in the Value method. The subset of these names that are being used for modeling may also be found in the test plan and responses InputSignalNames properties.
Examples	names = D.SignalNames;
See Also	SignalUnits, InputSignalNames, Value

Purpose   Names of units in data

Syntax   `units = D.SignalUnits`

Description   This is a property of `mbcmodel.data`.

D is the data object.

It returns a cell array of strings holding the units of the signals.

Examples   `units = D.SignalUnits;`

See Also   `SignalNames`

SingleVIF

Purpose	Single VIF matrix for linear model parameters
Syntax	VIF = SingleVIF(LINEARMODEL)
Description	This is a method of mbcmodel.linearmodel.
	VIF = SingleVIF(LINEARMODEL) calculates the single Variance Inflation Factor (VIF) matrix for the linear model parameters.
Examples	VIF = SingleVIF(knot_model)
See Also	ParameterStatistics

Purpose	Number of model parameters
Syntax	`N = params.SizeOfParameterSet`

Description   This is a property of `mbcmodel.linearmodelparameters`, for linear models only. It returns the total possible number of parameters in the model. Note that not all of these terms are necessarily currently included in the model, as you may remove some using StepwiseRegression.

Call NumberOfParameters to see how many terms are currently included in the model. Call StepwiseSelection to see which terms are included and excluded.

Use Names and Values to get the parameter names and values.

Examples   `N = knotparams.SizeOfParameterSet`

See Also   `NumberOfParameters`, `StepwiseSelection`, `Names`, `Values`

StatisticsDialog

Purpose   Open summary statistics dialog box

Syntax   [mdl,OK]= StatisticsDialog(mdl)

Description   This is a method of mbcmodel.model.

[mdl,OK]= StatisticsDialog(mdl) opens the Summary Statistics
dialog box, where you can select the summary statistics you want to use.

If you click **Cancel** to dismiss the dialog, OK = false and no changes
are made. If you click **OK** to close the dialog box, then OK = true and
your new chosen summary statistics are set up.

See Also   SummaryStatistics

Purpose   Model status: fitted, not fitted or best

Syntax   S = model.Status

Description This is a property of mbcmodel.model. It returns a string: 'Fitted' if the model is fitted, 'Not fitted' if the model is not fitted (for example there is not enough data to fit the model), or 'Best' if the model has been selected as best from some alternative models. A model must be Fitted before it can be selected as Best.

Examples
```
S = knot.Status
S =
    `Fitted'
```

See Also   ChooseAsBest

StepwiseRegression

Purpose   Change stepwise selection status for specified terms

Syntax   [S, model] = StepwiseRegression(model, optional toggleTerms)

Description   This is a method of mbcmodel.model, for linear models only. This
                     method returns the Stepwise table (as in the Stepwise values for
                     ParameterStatistics). Leave out toggleTerms to get the current
                     Stepwise values. You can choose to remove or include parameters using
                     StepwiseRegression, as long as their StepwiseStatus is Step.

                     The Stepwise values returned are the same as those found in the table
                     in the Stepwise GUI. For each parameter, the columns are: the value
                     of the coefficient, the standard error of the coefficient, the t value and
                     Next PRESS (the value of PRESS if the status of this term is changed at
                     the next iteration). Look for the lowest Next PRESS to indicate which
                     terms to toggle in order to improve the predictive power of the model.

                     Call StepwiseRegression to toggle between in and out for particular
                     parameters. toggleTerms can be either an index that specifies which
                     parameters to toggle, or an array or logical where a true value indicates
                     that a toggle should occur. The example shown toggles parameter 4,
                     after inspection of the Next PRESS column indicates changing the
                     status of this term will result in the lowest PRESS. StepwiseRegression
                     returns the new Stepwise values after toggling a parameter.

                     After making changes to the model using StepwiseRegression you must
                     call UpdateResponse.

                     Use StepwiseStatus (on the child modelparameters object) to see which
                     parameters have a status of Step; these can be toggled between in and
                     out using StepwiseRegression (on the parent model object).

                     Use StepwiseSelection (on the child modelparameters object) to view
                     which terms are in and out, as shown in the example.

Examples   [S, knot] = StepwiseRegression(knot)
                     S =

                        1.0e+003 *

```
      0.1316      0.0606      0.0200         NaN
      0.0000      0.0000      0.0200      2.0919
      0.0000      0.0000      0.0190      0.2828
     -0.0000      0.0000      0.0190      0.2531
      0.0000      0.0000      0.0190      0.2680
     -0.0551      0.0347      0.0200      0.2566
      0.0919      0.0264      0.0200      0.3672
     -0.0040      0.0023      0.0200      0.2564
     -0.0178      0.0095      0.0200      0.2644
      0.0008      0.0004      0.0200      0.2787

[S, knot] = StepwiseRegression(knot, 4)

S =

  129.8406     60.1899     19.0000         NaN
    0.0048      0.0008     19.0000    662.3830
    0.0000      0.0000     18.0000    290.8862
   -0.0021      0.0019     19.0000    245.9833
    0.0001      0.0002     18.0000    281.4104
  -50.4091     34.7401     19.0000    262.8346
   94.9675     26.3690     19.0000    400.6572
   -4.0887      2.2488     19.0000    262.6588
  -17.9412      9.4611     19.0000    276.7535
    0.8229      0.3734     19.0000    292.0827

params = knot.Parameters;
N = params.StepwiseSelection

N =
    'in'
    'in'
    'out'
    'in'
    'out'
    'in'
```

```
            'in'
            'in'
            'in'
            'in'

>> StepwiseRegression(knot, 4);
params = knot.Parameters;
N = params.StepwiseSelection

N =
    'in'
    'in'
    'out'
    'out'
    'out'
    'in'
    'in'
    'in'
    'in'
    'in'
```

See Also   StepwiseSelection, StepwiseStatus, UpdateResponse

Purpose   Model parameters currently included and excluded

Syntax   N = paramsknot.StepwiseSelection

Description   This is a read-only property of mbcmodel.linearmodelparameters, for
                  linear models only. It returns a status for each parameter in the model,
                  in or out, depending on whether the term is included or excluded. You
                  can choose to remove or include parameters using StepwiseRegression,
                  as long as their StepwiseStatus is Step. Call StepwiseRegression (on
                  the parent model object) to toggle between in and out for particular
                  parameters. You must then call UpdateResponse before calling
                  StepwiseSelection.

Examples   N = paramsknot.StepwiseSelection
                   N =
                       'in'
                       'in'
                       'out'
                       'out'
                       'out'
                       'in'
                       'in'
                       'in'
                       'in'
                       'in'

See Also   StepwiseRegression, StepwiseStatus, NumberOfParameters,
                 UpdateResponse

StepwiseStatus

Purpose   Stepwise status of parameters in model

Syntax   N = paramsknot.StepwiseStatus

Description This is a method of mbcmodel.linearmodelparameters, for linear
models only. It returns the stepwise status of each parameter in the
model.

The stepwise status for each term can be Always, Never or Step. The
status determines whether you can use the StepwiseRegression
function to throw away terms in order to try to improve the predictive
power of the model.

- Always - Always included in the model

- Never - Never included in the model

- Step - You can choose whether to include or exclude this term. Do
  this by using StepwiseRegression to toggle between in and out for
  particular parameters.

Use StepwiseSelection to find out which terms are currently included
and excluded.

Examples
```
N = paramsknot.StepwiseStatus
N =
    'Always'
    'Step'
    'Step'
    'Step'
    'Step'
    'Step'
    'Step'
    'Step'
    'Step'
    'Step'
```

See Also   StepwiseRegression, StepwiseSelection

SummaryStatistics

Purpose   Summary statistics for response

Syntax   S = SummaryStatistics(M)
                     S = SummaryStatistics(M, Names)

Description   This is a method of all model objects (mbcmodel.model
                     and mbcmodel.localmodel) and response objects
                     (mbcmodel.hierarchicalresponse, mbcmodel.localresponse, and
                     mbcmodel.response).

                     These statistics appear in the Summary Statistics pane of the Model
                     Browser GUI.

                     S = SummaryStatistics(M) returns summary statistics for the model
                     or response in a structure array containing Statistics and Names
                     fields.

                     S = SummaryStatistics(M, Names) returns summary statistics
                     specified by Names for the model or response in an array. Names can be a
                     char array, or a cell array of strings.

Examples   S = SummaryStatistics(R2);

See Also   DiagnosticStatistics, AlternativeModelStatistics

SummaryStatisticsForTest

Purpose   Statistics for specified test

Syntax   SS = SummaryStatisticsForTest(LocalResponse, TestNumber)
                     SS = SummaryStatisticsForTest(LocalResponse,TestNumber,Names)

Description   This is a method of mbcmodel.localresponse.

                    SS = SummaryStatisticsForTest(LocalResponse, TestNumber)
                    returns a structure array containing Statistics and Names fields values
                    for the local model for test TestNumber.

                    SS =
                    SummaryStatisticsForTest(LocalResponse,TestNumber,Names)
                    returns an array of the statistics specified by Names. Names can be a
                    char array, or a cell array of strings.

Examples   SS = SummaryStatisticsForTest(L, 22)

See Also   SummaryStatistics

Purpose   Structure array holding user-defined test filters

Syntax   testf = data.TestFilters

Description   This is a property of mbcmodel.data.

It returns a structure array holding information about the currently defined test filters for the data object D. The array will be the same length as the number of currently defined test filters, with the following fields for each filter:

- Expression — The string expression as defined in AddTestFilter or ModifyTestFilter.

- AppliedOK — Boolean indicating that the filter was successfully applied.

- RemovedTests — Boolean vector indicating which tests the filter removed. Note that many filters could remove the same test.

- Message — String holding information on the success or otherwise of the filter.

Examples   testf = data.TestFilters;

See Also   AddTestFilter, ModifyTestFilter, RemoveTestFilter

TestPlans

Purpose   Array of test plan objects in project

Syntax   tps = project.TestPlans

Description   This is a property of mbcmodel.project.

P is the project object.

Examples   tps = project.TestPlans;

Purpose   Valid model types

Syntax   ```
model.Type
M = mbcmodel.CreateModel(Type, NUMINPUTS)
M2 = CreateModel(M, Type)
```

Description   This is a property of `mbcmodel.model`.

`model.Type` returns the model type. This property is set at creation time. See `CreateModel`.

The model Type determines which properties you can set. To set properties, see `Properties`, and `LocalModel Properties`.

Note Spaces and case in model `Type` are ignored.

The model type must be one shown in the following table.

Type	Model Object
Polynomial	mbcmodel.linearmodel
Hybrid Spline	mbcmodel.linearmodel
RBF	mbcmodel.linearmodel
Hybrid RBF	mbcmodel.linearmodel
Polynomial-RBF	mbcmodel.linearmodel
Hybrid Spline-RBF	mbcmodel.linearmodel
Multiple Linear	mbcmodel.linearmodel
Free Knot Spline	mbcmodel.model
Transient	mbcmodel.model
User-Defined	mbcmodel.model
Neural Network	mbcmodel.model

Type

Type	Model Object
Local Polynomial Spline	mbcmodel.localmodel
Local Polynomial with Datum	mbcmodel.localmodel
Local Polynomial	mbcmodel.localmodel
Local Hybrid Spline	mbcmodel.localmodel
Local Truncated Power Series	mbcmodel.localmodel
Local Free Knot Spline	mbcmodel.localmodel
Local Multiple Models	mbcmodel.localmodel
Local Growth Model	mbcmodel.localmodel
Local User-defined Model	mbcmodel.localmodel
Local Transient Model	mbcmodel.localmodel
Local Average Fit	mbcmodel.localmodel

Get a list of types, using getAlternativeTypes, by entering the following syntax:

```
Mlist = getAlternativeTypes(M)
```

where M is an mbcmodel.model object.

Create an alternative model as follows: M = mbcmodel.CreateModel(Type, NUMINPUTS) or M2 = CreateModel(M, Type)

See Also   Properties, getAlternativeTypes, CreateModel

Purpose   Model output units

Syntax   ```
model.Units
modelinput.Units
```

**Description**  This is a property of `mbcmodel.model` and `mbcmodel.modelinput` objects.

`model.Units` or `modelinput.Units` return the units of the model or modelinput object.

This property is set to the data signal units when the response is created or if a model is assigned to a response. This property cannot be set when a response is attached to the model.

# UpdateResponse

**Purpose**      Replace model in response

**Syntax**       UpdateResponse(model)
                 M = UpdateResponse( M , R); updates the response specified by R

**Description**  This is a method of mbcmodel.model. This takes the model and places it
                 back into the response it came from. Appropriate action is taken if a
                 refit is necessary because you have modified either the model, response
                 data or model data in the interim. For example, if you have changed
                 the model type, the new model is fitted to the response data. If you
                 have changed the response data (e.g. removed an outlier), the model is
                 fitted to the new response data.

                 Note that when changing the model type or settings (using the
                 ModelSetup command) the response is not refitted until you
                 call UpdateResponse. If you have changed the model by using
                 StepwiseRegression you must call UpdateResponse.

                     UpdateResponse( M )

                 updates the model in the response associated with the model.

                     M = UpdateResponse( M , R);

                 updates the response specified by R.

**Examples**     UpdateResponse(knot);

**See Also**     ModelSetup

**Purpose**          Refit response feature models

**Syntax**           UpdateResponseFeatures(L)

**Description**      This is a method of mbcmodel.localresponse.

UpdateResponseFeatures(L) refits all response feature models. You
need to call this if you used RemoveOutliersForTest without specifying
refitting the response features (doUpdate set to false).

**Examples**        For a local response LOCALRESPONSE, to remove first two data points
without updating response features:

    RemoveOutliersForTest(LOCALRESPONSE,1,1:2,false);

To update response features:

    UpdateResponseFeatures(LOCALRESPONSE);

**See Also**        RemoveOutliersForTest, RestoreDataForTest

# UserVariables

| | |
|---|---|
| **Purpose** | Structure array holding user-defined variables |
| **Syntax** | `userV = D.UserVariables` |
| **Description** | This is a property of `mbcmodel.data`. |

This returns a structure array holding information about the currently defined filters. The array will be the same length as the number of currently defined variables, with fields

- `Variable` — variable name
  - `Expression` — The string expression as defined in `AddVariable` or `ModifyVariable`
  - `Units` — The string defining the units
  - `AppliedOK` — Boolean indicating that the variable expression was successfully applied
  - `Message` — String holding information on the success or otherwise of the variable

**Examples**

```
myvars = D1.UserVariables
```

This returns the following information about the user-defined variable in the example data object `D1`:

```
   Variable: 'BSFC'
 Expression: 'BSFC = FUELFLO./(BTQ.*(ENGSPEED*2*pi/60))'
      Units: 'kg/Nm'
  AppliedOK: 1
    Message: 'Variable successfully added'
```

`Variable` is the parsed name of the variable being added. Note that this might differ from the string used in `AddVariable` because the `SignalName` must be a valid MATLAB variable name, and hence MBC will parse and modify the input string appropriately.

See Also   AddVariable, ModifyVariable, RemoveVariable

Value

Purpose	Double data from data object
Syntax	`val = Value(D, varNames, testNumbers)`
Description	This is a method of `mbcmodel.data`.

Use this to extract particular data values.

`varNames` is an optional input that specifies either the name of the signal that you want to extract (such as `'SPK'`) or an array of names (`{'SPK' 'AFR' 'TQ'}`) the indices of the signals (`[1 4 5]`). Defaults to ':' meaning all.

`testNumbers` is an optional input that specifies which test indices you want. Defaults to ':' meaning all.

`val` outputs the double values held in the data.

Examples

```
dblValues = Value(D, 'SPK', 1);
dblValues = Value(D, {'SPK' 'AFR'}, ':');
dblValues = Value(D, [1 3 4 5]);
dblValues = Value(D, ':', [1 4 6 8]);
```

See Also `SignalNames`

Purpose   Values of model parameters

Syntax   `vals = paramsknot.Values`

Description   This is a read-only property of `mbcmodel.modelparameters`. It returns the value of each parameter in the model. Use Names to find out the names of these terms.

Examples   `vals = paramsknot.Values;`

See Also   `Names`

Widths

Purpose   Width data from RBF model

Syntax   Width = params.Widths

Description   This is a property of `mbcmodel.rbfmodelparameters`, for Radial Basis Function (RBF) models only.

Width is usually a single value, but can also be of size 1 by number of variables in the case of the width per dimension algorithm, or number of centers by number of variables in the case of tree regression.

Examples   Width = params.Widths;

See Also   Centers

Purpose   X (or input) data for model

Syntax   D = model.XData

Description   This has been replaced by InputData, use this instead.

                   This is a property of mbcmodel.model. It returns an array of the input
                   variable data currently in the model.

Examples   D = knot.XData

See Also   InputData, XDataNames, YData

XDataNames

Purpose	X data (or input) variable names for model
Syntax	`D = model.XDataNames`
Description	This is a property of `mbcmodel.model`. It returns the names of the input variables in the data.
Examples	`D = knot.XDataNames;`
See Also	`XData`

Purpose   Y (or response) data for model

Syntax   D = model.YData

Description   This has been replaced by OutputData, use this instead.

This is a property of mbcmodel.model.

It returns an array of the response data currently in the model.

Examples   D = knot.YData;

See Also   OutputData, XData