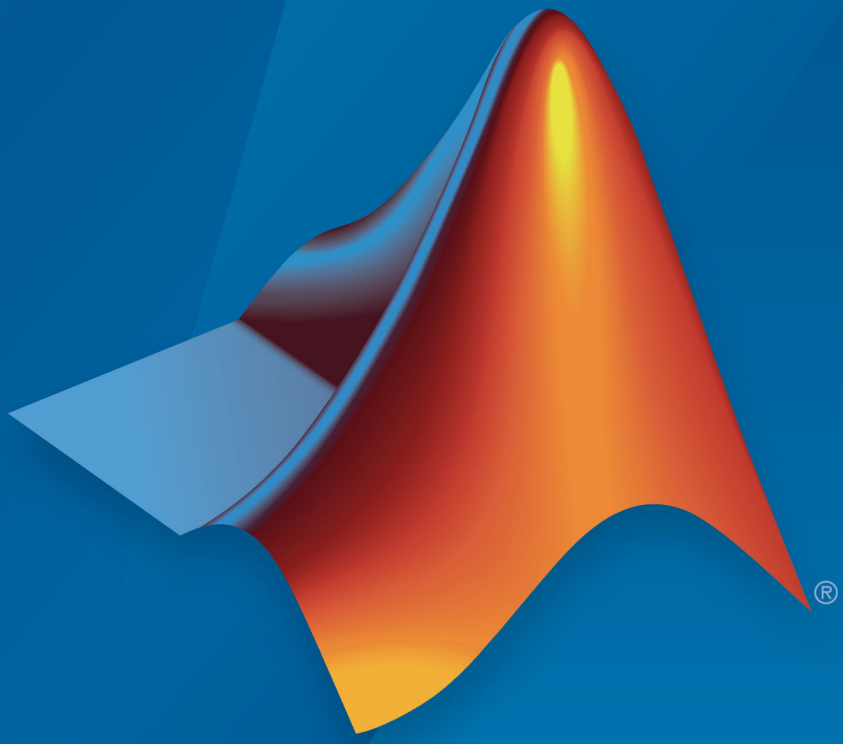
Fuzzy Logic Toolbox™ Release Notes



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Version: 2.3

New Features

Bug Fixes

Code Generation Improvements: Generate code for single and fixed-point data types, and custom membership and inference functions

The Fuzzy Logic Controller block now supports code generation for fuzzy systems using:

- Single-precision data.
- Fixed-point data. To generate code for fixed-point data, you need Fixed-Point Designer™ software.
- Custom membership functions and custom inference functions. For more information on specifying custom functions for a fuzzy system, see “Build Fuzzy Systems Using Custom Functions”.

You can generate code using either Simulink® Coder™ or Simulink PLC Coder™ software.

PLC Deployment: Generate IEC 61131-3 Structured Text from fuzzy logic controllers

The Fuzzy Logic Controller block now supports generation of IEC 61131-3 Structured Text for PLC deployment using Simulink PLC Coder software.

Fuzzy Logic Controller Block Improvements: Configure additional block parameters, and access intermediate fuzzy inference results

For the Fuzzy Logic Controller block, you can now:

- Use a double-precision, single-precision, or fixed-point data type.
- Specify the number of sample points for evaluating the output range of a Mamdani system.
- Access intermediate fuzzy inference results using new optional output ports.

For more information, see Fuzzy Logic Controller.

evalfis Command: Evaluate FIS output variable ranges over a smaller number of sample points

You can now specify the number of sample points for evaluating the output range of a Mamdani fuzzy inference system at the command line as any value greater than `1`. Previously, the minimum value was `101`.

This change applies to the:

- `numPts` input argument of `evalfis`.
- `NumSamplePoints` property of `gensurfOptions`.

R2017a

Unified genfis Command: Generate fuzzy inference system structures using a single command

The commands for generating the structure of a fuzzy inference system have been unified into a single `genfis` command, which you configure using a new `genfisOptions` option set.

Starting in R2017a, to generate a FIS structure, first create a default `genfisOptions` option set, specifying one of the following structure generation algorithms:

- Grid partitioning

  ```
  opt = genfisOptions('GridPartition');
  ```

- Subtractive clustering

  ```
  opt = genfisOptions('SubtractiveClustering');
  ```

- Fuzzy c-means clustering

  ```
  opt = genfisOptions('FCMClustering');
  ```

You can then modify the options using dot notation. Any options you do not modify remain at their default values.

Compatibility Considerations

Previously, to generate FIS structures, you used the `genfis1`, `genfis2`, or `genfis3` commands with optional input arguments.

These commands may be removed in a future release and, starting in R2017a, using these commands generates a warning. If your code uses `genfis1`, `genfis2`, or `genfis3`, modify the code to use the `genfis` command, specifying options using a `genfisOptions` option set.

Algorithm	Old Syntax	New Syntax

Grid partitioning	`fis = genfis1(data,numMFs,inmftype,outmftype)`	`opt = genfisOptions('GridPartition');`
		`opt.NumMembershipFunctions = numMFs;`
		`opt.InputMembershipFunctionType = inmftype;`
		`opt.OutputMembershipFunctionType = outmftype`
		`inputData = data(:,end-1);`
		`outputData = data(:,end);`
		`fis = genfis(inputData,outputData,opt);`

Algorithm	Old Syntax	New Syntax

Subtractive clustering	`fis = genfis2(inputData,outputData,radii,xBounds,options,userCenters);`	`opt = genfisOptions('SubtractiveClustering');`
		`opt.ClusterInfluenceRange = radii;`
		`opt.DataScale = xBounds;`
		`opt.SquashFactor = options(1);`
		`opt.AcceptRatio = options(2);`
		`opt.RejectRatio = options(3);`
		`opt.Verbose = options(4);`
		`opt.CustomClusterCenters = userCenters;`
		`fis = genfis(inputData,outputData,opt);`

FCM clustering	`fis = genfis3(inputData,outputData,type,cluster_n,fcmoptions);`	`opt = genfisOptions('FCMClustering');`
		`opt.FISType = type;`
		`opt.NumClusters = cluster_n;`
		`opt.Exponent = fcmoptions(1);`
		`opt.MaxNumIteration = fcmoptions(2);`
		`opt.MinImprovement = fcmoptions(3);`
		`opt.Verbose = fcmoptions(4);`
		`fis = genfis(inputData,outputData,opt);`

The syntaxes in this table assume that you are specifying all the options for each algorithm. Since the initial `genfisOptions` option set contains default algorithm options, you have to specify only nondefault options. For example, create an FIS using FCM clustering with three clusters, leaving all other options at their default values.

```
opt = genfisOptions('FCMClustering');
opt.NumClusters = 3;
fis = genfis(Xin,Xout,opt);
```

anfisOptions Command: Specify options for training adaptive neuro-fuzzy inference systems

To specify options for training adaptive neuro-fuzzy inference systems using the `anfis` command, you now create an `anfisOptions` option set. You can then modify the options using dot notation. Any options you do not modify remain at their default values.

Compatibility Considerations

Previously, to train an adaptive neuro-fuzzy inference system using `anfis`, you specified the training options using optional input arguments.

```
fis = anfis(trnData,initFIS,trnOpt,dispOpt,chkData,optMethod);
```

Starting in R2017a, if your code uses `anfis`, modify the code to use an `anfisOptions` option set.

```
opt = anfisOptions;
opt.InitialFIS = 3;
fis = anfis(trnData,opt);
```

The following table shows the mapping of the old `anfis` input arguments to the new `anfisOptions` option set.

Old `anfis` Input Argument	New `anfisOptions` Option
`initFIS`	`InitialFIS`
`trnOpt(1)`	`EpochNumber`
`trnOpt(2)`	`ErrorGoal`
`trnOpt(3)`	`InitialStepSize`
`trnOpt(4)`	`StepSizeDecreaseRate`
`trnOpt(5)`	`StepSizeIncreaseRate`
`dispOpt(1)`	`DisplayANFISInformation`
`dispOpt(2)`	`DisplayErrorValues`
`dispOpt(3)`	`DisplayStepSize`
`dispOpt(4)`	`DisplayFinalResults`
`chkData`	`ValidationData`
`optMethod`	`OptimizationMethod`

gensurfOptions Command: Specify options for generating fuzzy inference system output surfaces

To specify options for generating fuzzy inference system output surfaces using the `gensurf` command, you now create a `gensurfOptions` option set. You can then modify the options using dot notation. Any options you do not modify remain at their default values.

Compatibility Considerations

Previously, to generate an output surface for a fuzzy inference system using `gensurf`, you specified the generation options using optional input arguments.

```
gensurf(fis,inputs,output,grids,refInput,points);
```

Starting in R2017a, if your code uses `gensurf`, modify the code to use a `gensurfOptions` option set.

```
opt = gensurfOptions;
opt.InputIndex = [1 3];
fis = gensurf(fis,opt);
```

The following table shows the mapping of the old `gensurf` input arguments to the new `gensurfOptions` option set.

Old `gensurf` Input Argument	New `gensurfOptions` Option
`inputs`	`InputIndex`
`output`	`OutputIndex`
`grids`	`NumGridPoints`
`refinput`	`ReferenceInputs`
`points`	`NumSamplePoints`

newfis Command: Specify options using Name,Value pairs

To specify options for creating new fuzzy inference systems using the `newfis` command, you now use `Name,Value` pair arguments. Any `Name,Value` pair arguments that you do not specify remain at their default values.

Compatibility Considerations

Previously, you specified options for the `newfis` command using optional input arguments.

```
fis = newfis('My FIS',fisType,andMethod,orMethod,impMethod,aggMethod,defuzzMethod);
```

Starting in R2017a, if your code uses `newfis`, modify the code to use one or more `Name,Value` pair arguments. For example, create a Mamdani FIS with default options.

```
fis = newfis('My FIS','FISType','mamdani');
```

The following table shows the mapping of the old input arguments to the new `Name,Value` pair arguments.

Old `newfis` Input Argument	New `Name,Value` Argument
`fisType`	`'FISType'`
`andMethod`	`'AndMethod'`
`orMethod`	`'OrMethod'`
`impMethod`	`'ImplicationMethod'`
`aggMethod`	`'AggregationMethod'`
`defuzzMethod`	`'DefuzzificationMethod'`

parsrule Command: Specify options using Name,Value pairs

To specify options for creating new fuzzy inference systems using the `parsrule` command, you now use `Name,Value` pair arguments. Any `Name,Value` pair arguments that you do not specify remain at their default values.

Compatibility Considerations

Previously, you specified options for the `parsrule` command using optional input arguments `ruleFormat` and `lang`.

```
outFIS = parsrule(inFIS,ruleList,ruleFormat,lang);
```

Starting in R2017a, if your code uses `newfis`, modify the code to use one or more `Name,Value` pair arguments. For example, add a list of rules in `'symbolic'` format.

```
fis = parsrule(inFIS,ruleList,'Format','symbolic');
```

The following table shows the mapping of the old input arguments to the new `Name,Value` pair arguments.

Old `parsrule` Input Argument	New `Name,Value` Argument
`ruleFormat`	`'Format'`
`lang`	`'Language'`

showrule Command: Specify options using Name,Value pairs

To specify options for viewing the rules of a fuzzy inference system using the `showrule` command, you now use `Name,Value` pair arguments. Any `Name,Value` pair arguments that you do not specify remain at their default values.

Compatibility Considerations

Previously, you specified options for the `showrule` command using optional input arguments `indexList`, `format`, and `lang`.

```
showrule(fis,indexList,format,lang);
```

Starting in R2017a, if your code uses `newfis`, modify the code to use one or more `Name,Value` pair arguments. For example, view the first fuzzy rule in `fis`.

```
showrule(fis,'RuleIndex',1);
```

The following table shows the mapping of the old input arguments to the new `Name,Value` pair arguments.

Old `showrule` Input Argument	New `Name,Value` Argument
`indexList`	`'RuleIndex'`
`format`	`'Format'`
`lang`	`'Language'`

subclust Command: Specify options using Name,Value pairs

To specify options for subtractive clustering using the `subclust` command, you now use `Name,Value` pair arguments. Any `Name,Value` pair arguments that you do not specify remain at their default values.

Compatibility Considerations

Previously, you specified options for the `subclust` command using optional input arguments `xBounds` and `options`.

```
fisOut = subclust(fisIn,radii,xBounds,options);
```

Starting in R2017a, if your code uses `newfis`, modify the code to use one or more `Name,Value` pair arguments. For example, specify clustering options.

```
fisOut = subclust(fisIn,radii,'Options',options);
```

The following table shows the mapping of the old input arguments to the new `Name,Value` pair arguments.

Old `subclust` Input Argument	New `Name,Value` Argument
`xBounds`	`'DataScale'`
`options`	`'Options'`

Obtain fuzzy inference system properties using improved getfis command

Several `getfis` syntaxes that previously printed formatted properties to the Command Window and also returned properties now perform a single action.

- `getfis(fis)` now just prints FIS properties to the Command Window.
- `getfis(fis,vartype,varindex)` now just returns variable properties in a structure.
- `getfis(fis,vartype,varindex,'mf',mfIndex)` now just returns membership function properties in a structure.

Compatibility Considerations

Starting in R2017a, the following `getfis` syntaxes have a new behavior.

Syntax	Previous Behavior	New Behavior
`getfis(fis)`	Print formatted list of FIS properties to Command Window, and return FIS name.	Print formatted list of FIS properties to Command Window.
`getfis(fis,varType,varIndex)`	Print formatted list variable properties to Command Window, and return structure that contains variable properties.	Return structure that contains variable properties.

Syntax	Previous Behavior	New Behavior
`getfis(fis,varType,varIndex,'mf',mfIndex)`	Print formatted list membership function properties to Command Window, and return structure that contains membership function properties.	Return structure that contains membership function properties.

Functionality being removed or changed

Functionality	Result	Use This Instead	Compatibility Considerations
`genfis1`, `genfis2`, and `genfis3` commands	Warns	`genfis` command	See "Unified genfis Command: Generate fuzzy inference system structures using a single command" on page 2-2.
Specify optional input arguments for the `anfis` command	Still works	Specify options using `anfisOptions` command.	See "anfisOptions Command: Specify options for training adaptive neuro-fuzzy inference systems" on page 2-3.
Specify optional input arguments for the `gensurf` command	Still works	Specify options using `gensurfOptions` command.	See "gensurfOptions Command: Specify options for generating fuzzy inference system output surfaces" on page 2-4.
Specify optional input arguments for `newfis` command	Still works	Specify options using `Name,Value` pair arguments.	See "newfis Command: Specify options using Name,Value pairs" on page 2-5.
Specify optional input arguments for `parsrule` command	Still works	Specify options using `Name,Value` pair arguments.	See "parsrule Command: Specify options using Name,Value pairs" on page 2-6.
Specify optional input arguments for `showrule` command	Still works	Specify options using `Name,Value` pair arguments.	See "showrule Command: Specify options using Name,Value pairs" on page 2-7.
Specify optional input arguments for `subclust` command	Still works	Specify options using `Name,Value` pair arguments.	See "subclust Command: Specify options using Name,Value pairs" on page 2-7.

Functionality	Result	Use This Instead	Compatibility Considerations
`getfis` command syntaxes that both print and return properties	Still works	Syntaxes now either print or return properties, not both.	See "Obtain fuzzy inference system properties using improved getfis command" on page 2-8.

R2016b

Version: 2.2.24

New Features

Bug Fixes

Standalone Applications for ANFIS Training: Deploy neuro-adaptive fuzzy inference code using MATLAB Compiler

The `anfis` command now supports application deployment using MATLAB® Compiler™. For more information on building and deploying standalone applications from MATLAB programs, see MATLAB Compiler.

R2016a

Version: 2.2.23

Bug Fixes

R2015b

Version: 2.2.22

Bug Fixes

R2015a

Version: 2.2.21

Bug Fixes

R2014b

Version: 2.2.20

New Features

Bug Fixes

Commands to open Fuzzy Logic Designer and Neuro-Fuzzy Designer renamed

`fuzzy` is renamed to `fuzzyLogicDesigner`. Use this command to open the Fuzzy Logic Designer app.

`anfisedit` is renamed to `neuroFuzzyDesigner`. Use this command to open the Neuro-Fuzzy Designer app.

R2014a

Version: 2.2.19

New Features

Bug Fixes

Example that shows how to use a fuzzy inference system to detect edges in an image

The Fuzzy Logic Image Processing example shows how to use a fuzzy inference system to detect edges in an image.

R2013b

Version: 2.2.18

Bug Fixes

R2013a

Version: 2.2.17

No New Features or Changes

R2012b

Version: 2.2.16

No New Features or Changes

R2012a

Version: 2.2.15

No New Features or Changes

R2011b

Version: 2.2.14

No New Features or Changes

R2011a

Version: 2.2.13

No New Features or Changes

R2010b

Version: 2.2.12

No New Features or Changes

R2010a

Version: 2.2.11

No New Features or Changes

R2009b

Version: 2.2.10

No New Features or Changes

R2009a

Version: 2.2.9

No New Features or Changes

R2008b

Version: 2.2.8

No New Features or Changes

R2008a

Version: 2.2.7

No New Features or Changes

R2007b

Version: 2.2.6

New Features

New Demo

Fuzzy Logic Toolbox software has a new demo Fuzzy C-Means Clustering for Iris Data, which illustrates the use of Fuzzy C-Means clustering for Iris dataset.

R2007a

Version: 2.2.5

No New Features or Changes

R2006b

Version: 2.2.4

No New Features or Changes

R2006a

Version: 2.2.3

No New Features or Changes

R14SP3

Version: 2.2.2

No New Features or Changes

R14SP2

Version: 2.2.1

No New Features or Changes