pdemesh

Plot PDE mesh

Syntax

```
pdemesh(model)
pdemesh(mesh)
pdemesh(nodes,elements)
pdemesh(model,u)
pdemesh( ___ ,Name,Value)

pdemesh(p,e,t)
pdemesh(p,e,t,u)

h = pdemesh( ___ )
```

Description

`pdemesh(model)` plots the mesh contained in a 2-D or 3-D `model` object of type `PDEModel`. example

`pdemesh(mesh)` plots the mesh defined as a `Mesh` property of a 2-D or 3-D `model` object of type `PDEModel`. example

`pdemesh(nodes,elements)` plots the mesh defined by `nodes` and `elements`. example

`pdemesh(model,u)` plots solution data `u` as a 3-D plot. This syntax is valid only for 2-D geometry. example

`pdemesh( ___ ,Name,Value)` plots the mesh or solution data using any of the arguments in the previous syntaxes and one or more `Name,Value` pair arguments. example

`pdemesh(p,e,t)` plots the mesh specified by the mesh data `p,e,t`. example

`pdemesh(p,e,t,u)` plots PDE node or triangle data `u` using a mesh plot. The function plots the node data if `u` is a column vector , and triangle data if `u` is a row vector. example

If you want to have more control over your mesh plot, use `pdeplot` or `pdeplot3D` instead of `pdemesh`.

`h = pdemesh( ___ )` returns handles to the graphics, using any of the arguments of the previous syntaxes.

Examples

collapse all

Mesh Plot for L-Shaped Membrane

Create a mesh plot and display the node and element labels of the mesh.

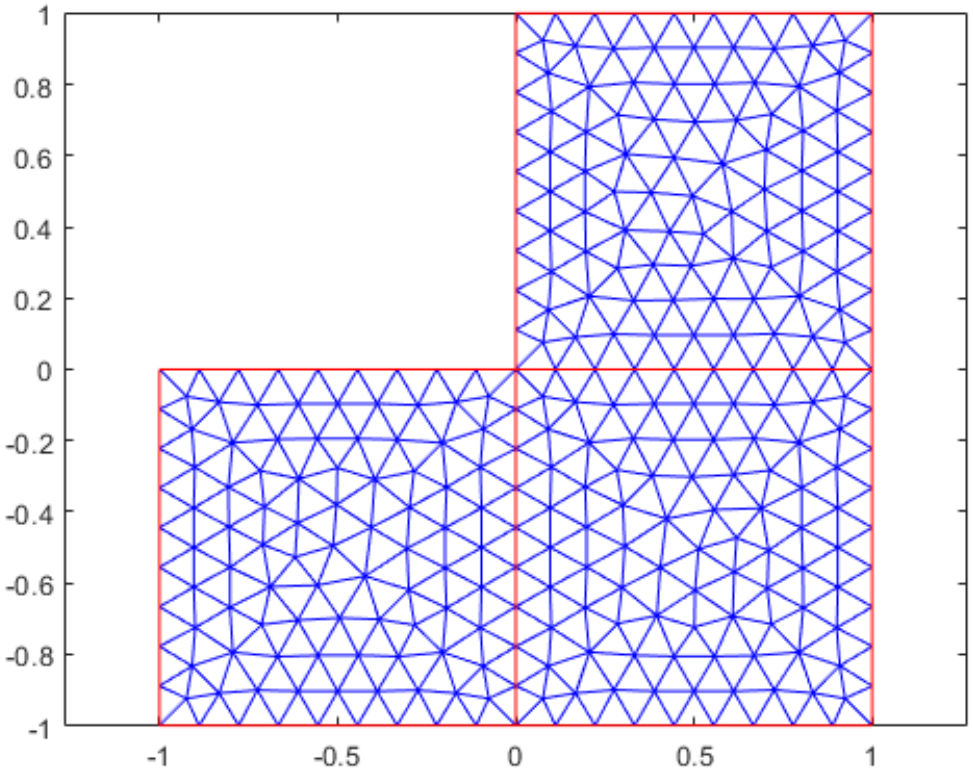
Open Live Script

Create a PDE model. Include the geometry of the built-in function `lshapeg`. Mesh the geometry.

```
model = createpde;
geometryFromEdges(model,@lshapeg);
mesh = generateMesh(model);
```

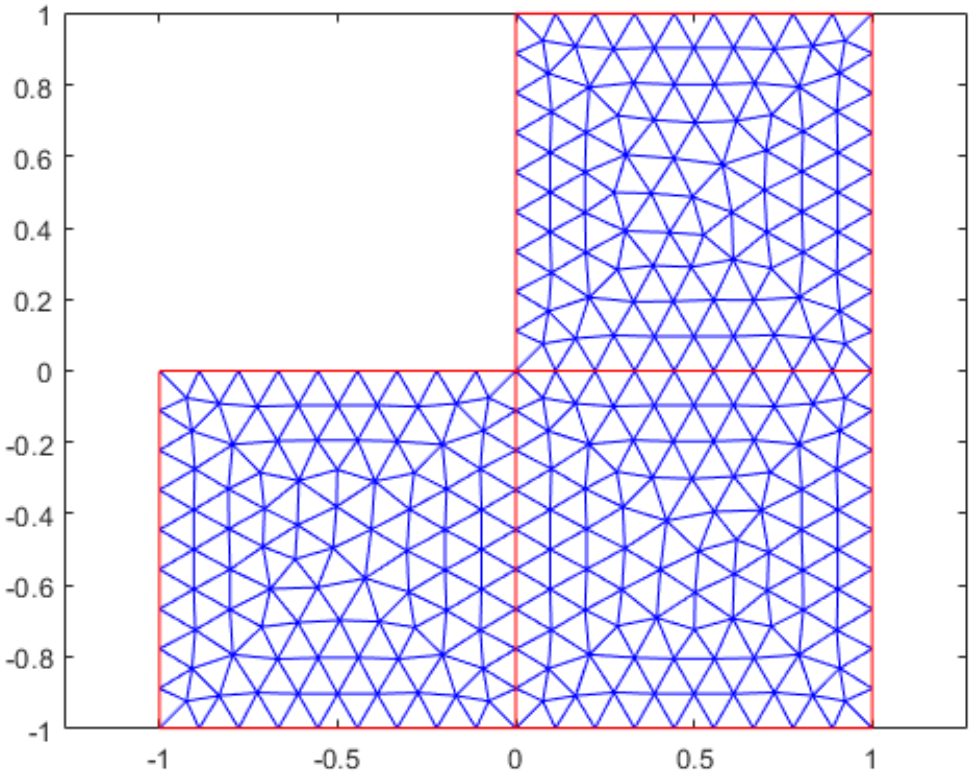
Plot the mesh.

```
pdemesh(model)
```



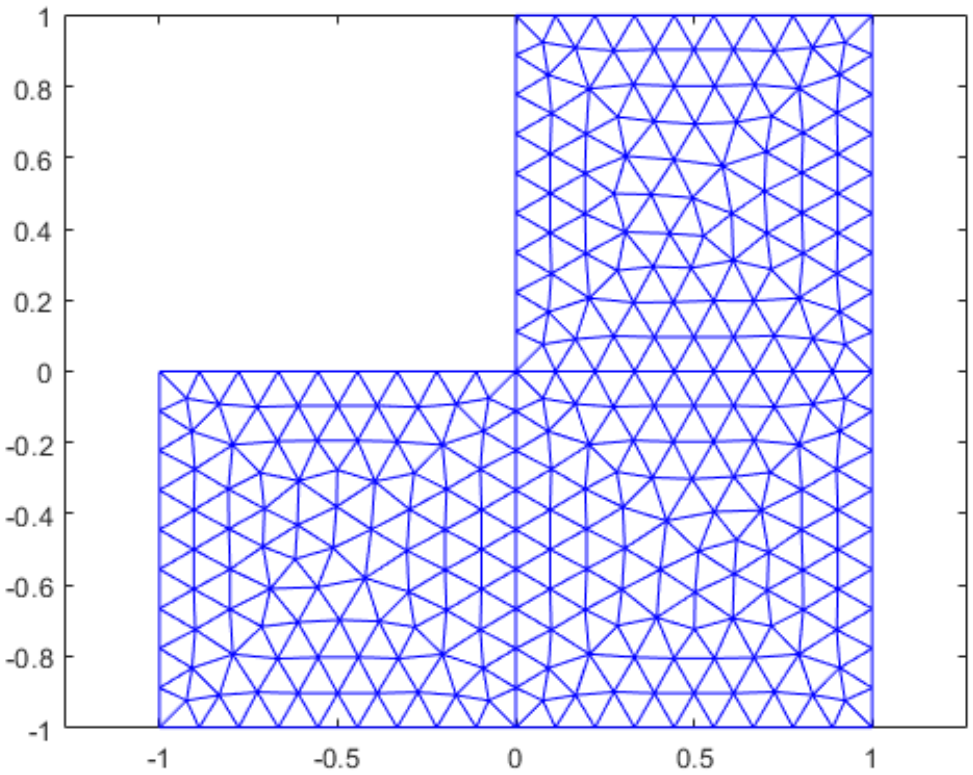
Alternatively, you can plot a mesh by using `mesh` as an input argument.

```
pdemesh(mesh)
```



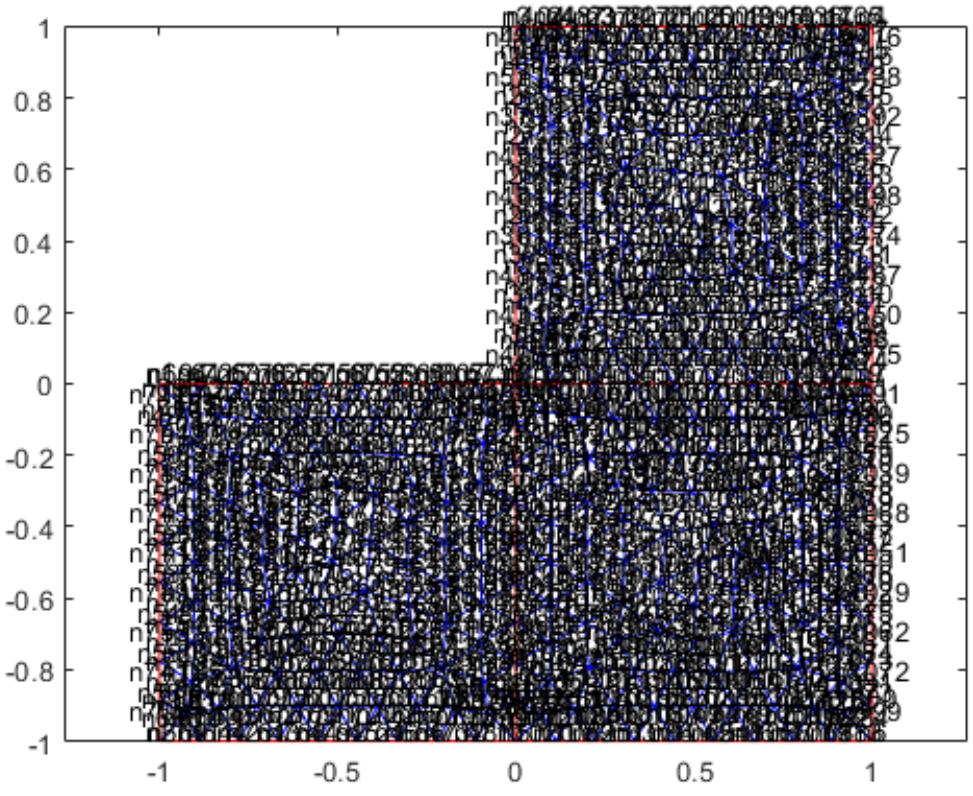
Another approach is to use the nodes and elements of the mesh as input arguments for `pdemesh`.

```
pdemesh(mesh.Nodes,mesh.Elements)
```



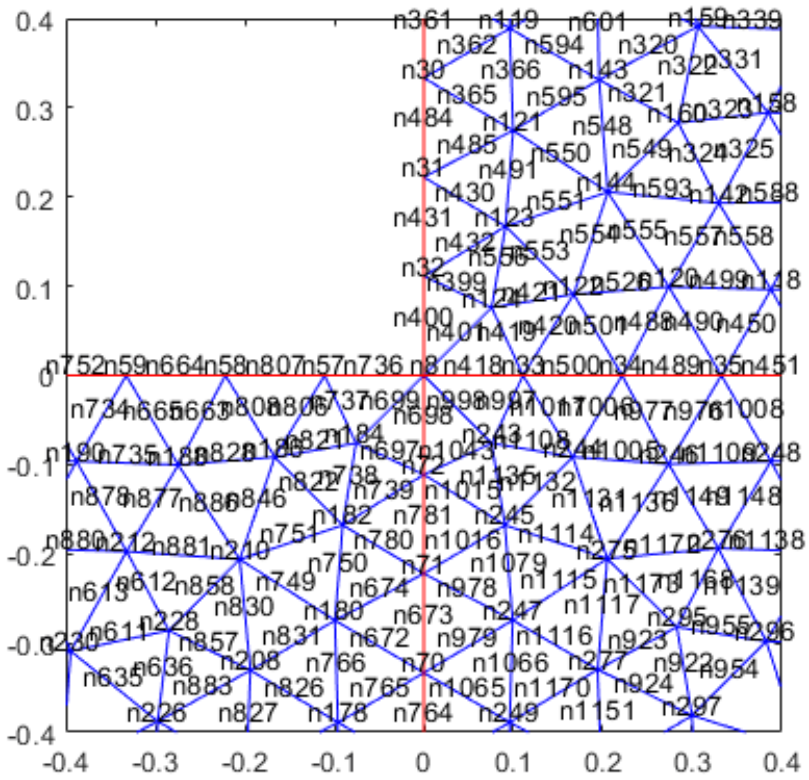
Display node labels.

```
pdemesh(model,'NodeLabels','on')
```



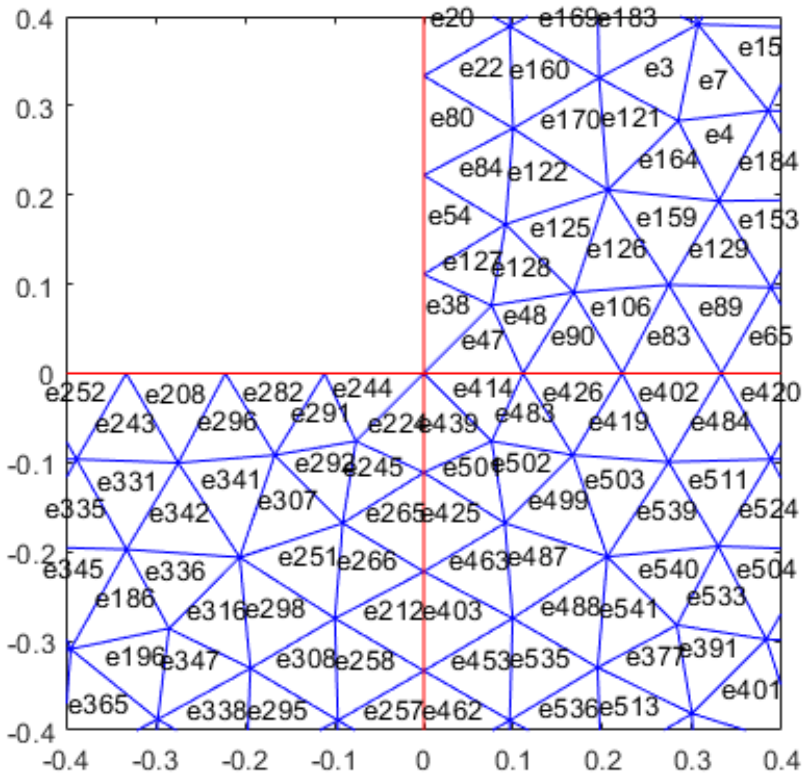
Use `xlim` and `ylim` to zoom in on particular nodes.

```
xlim([-0.4,0.4])
ylim([-0.4,0.4])
```



Display element labels.

```
pdemesh(model,'ElementLabels','on')
xlim([-0.4,0.4])
ylim([-0.4,0.4])
```



Apply boundary conditions, specify coefficients, and solve the PDE.

```
applyBoundaryCondition(model,'dirichlet', ...
                            'Edge',1:model.Geometry.NumEdges, ...
                            'u',0);
specifyCoefficients(model,'m',0,...
                          'd',0,...
                          'c',1,...
                          'a',0,...
                          'f',1);
generateMesh(model);
results = solvepde(model)
```

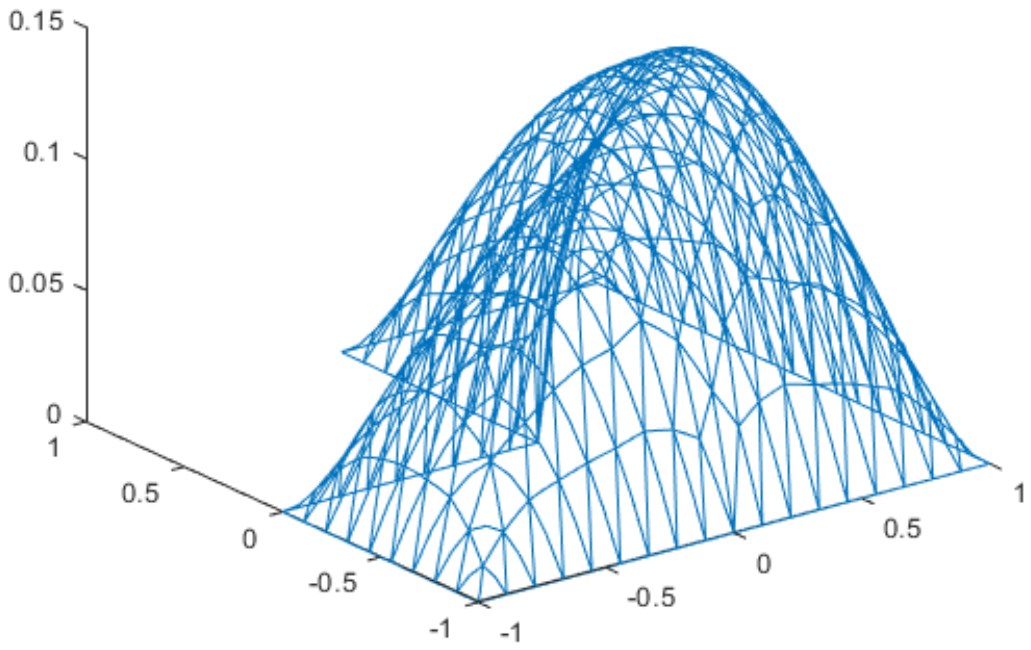
```
results =
  StationaryResults with properties:

    NodalSolution: [1177x1 double]
       XGradients: [1177x1 double]
       YGradients: [1177x1 double]
       ZGradients: []
             Mesh: [1x1 FEMesh]
```

```
u = results.NodalSolution;
```

Plot the solution at nodal locations by using `pdemesh`.

```
pdemesh(model,u)
```



The `pdemesh` function ignores `NodeLabels` and `ElementLabels` when you plot solution data as a 3-D plot.

Transparency for 3-D Mesh

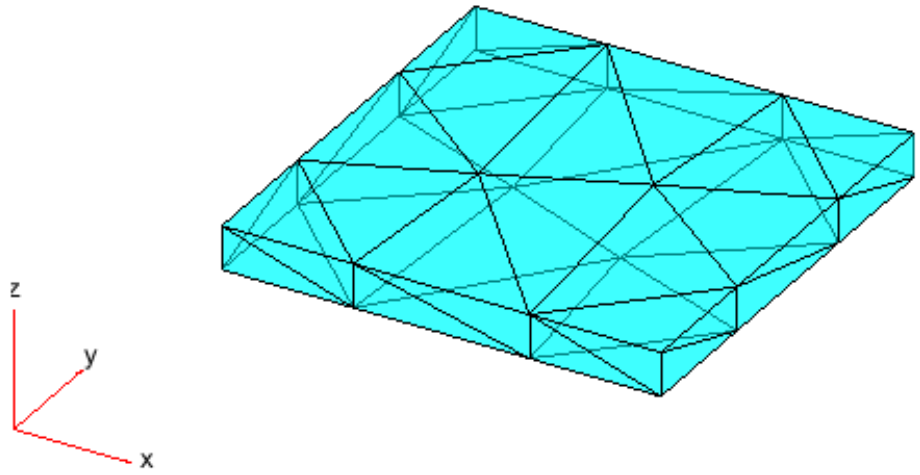
Create a PDE model, include the geometry and mesh it.

Open Live Script

```
model = createpde;
importGeometry(model,'Plate10x10x1.stl');
generateMesh(model,'Hmax',5);
```

Plot the mesh setting the transparency to 0.5.

```
pdemesh(model,'FaceAlpha',0.5)
```



Elements Associated with Particular Face

Find the elements associated with a geometric region.

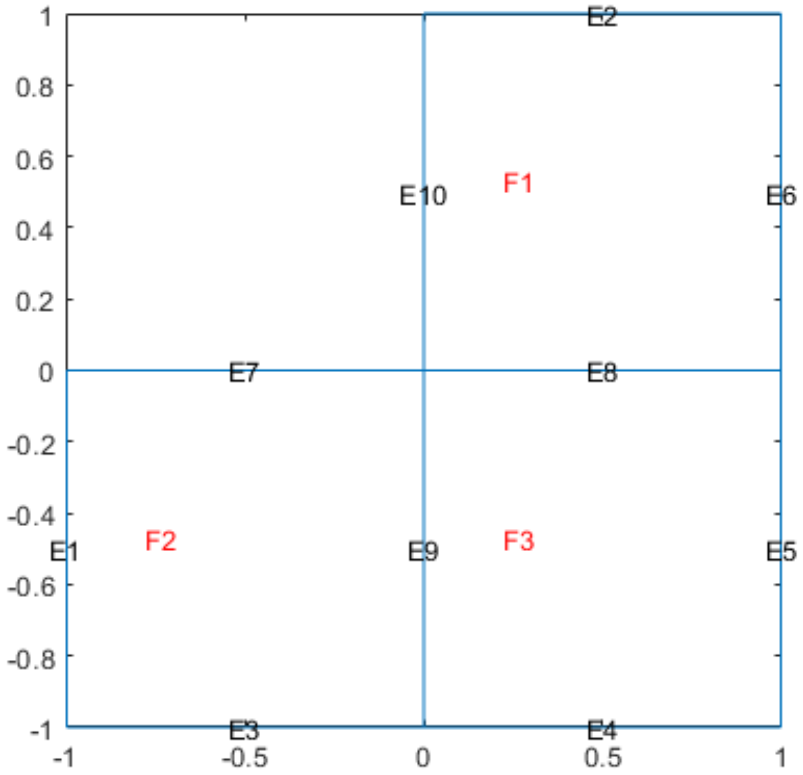
Open Live Script

Create a PDE model.

```
model = createpde;
```

Include the geometry of the built-in function `lshapeg`. Plot the geometry.

```
geometryFromEdges(model,@lshapeg);
pdegplot(model,'FaceLabels','on','EdgeLabels','on')
```



Generate a mesh.

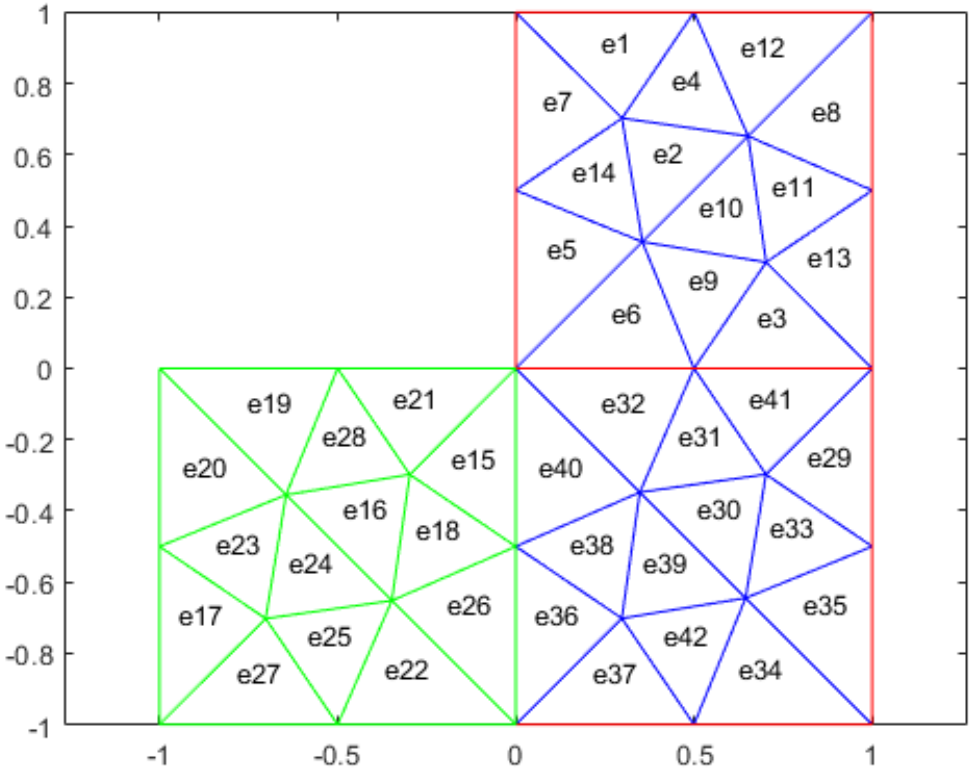
```
mesh = generateMesh(model,'Hmax',0.5);
```

Find the elements associated with face 2.

```
Ef2 = findElements(mesh,'region','Face',2);
```

Highlight these elements in green on the mesh plot.

```
figure
pdemesh(mesh,'ElementLabels','on')
hold on
pdemesh(mesh.Nodes,mesh.Elements(:,Ef2),'EdgeColor','green')
```

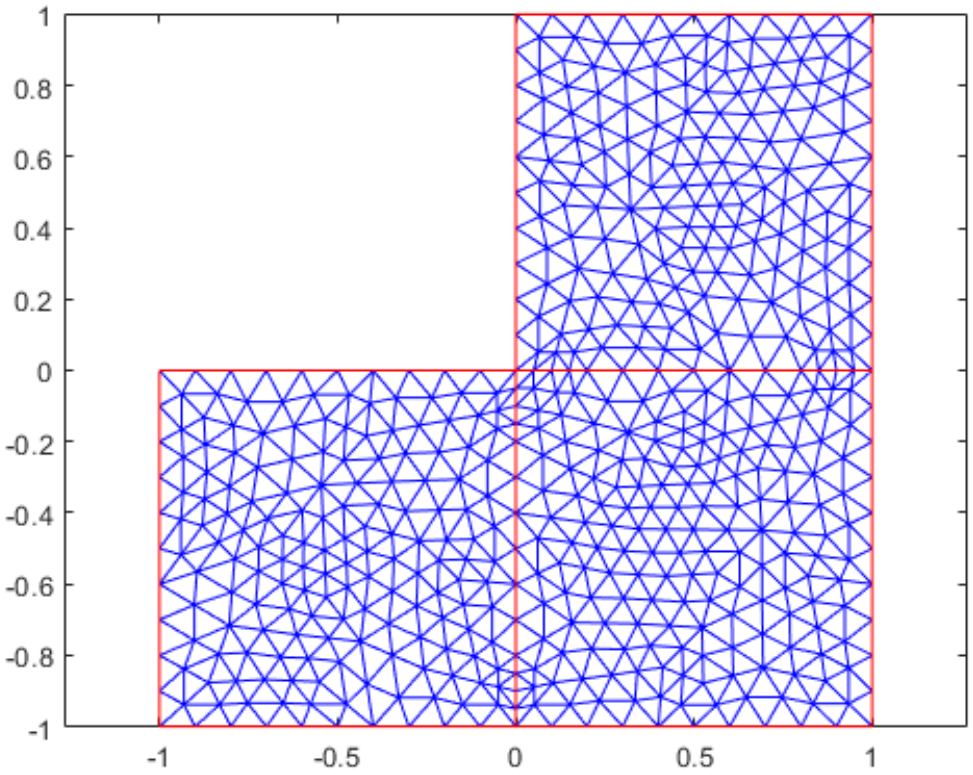


[p,e,t] Mesh Plot

Plot the mesh for the geometry of the L-shaped membrane.

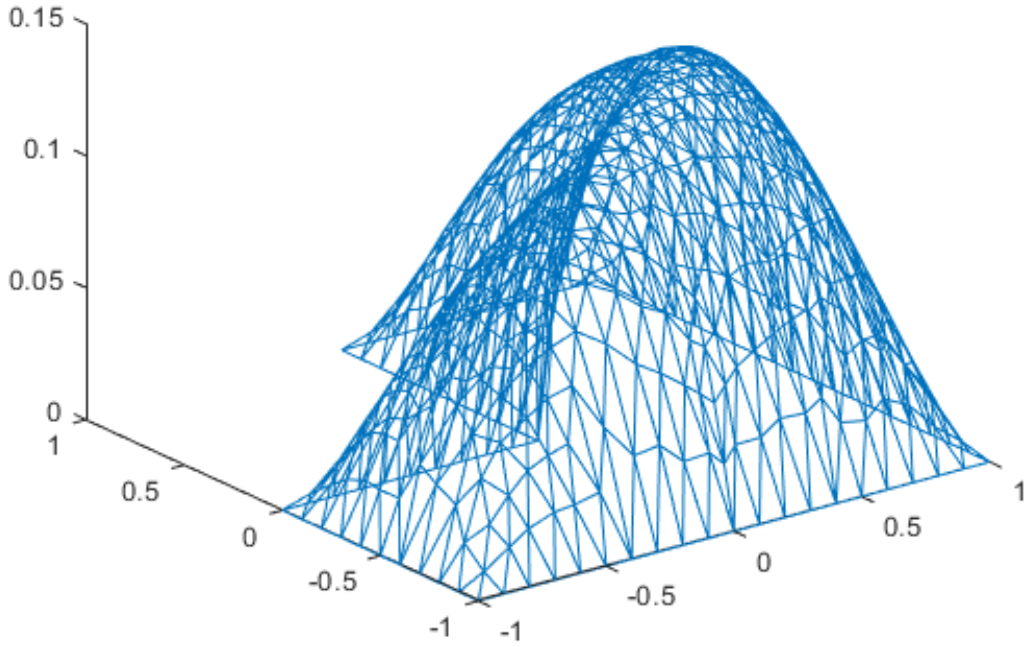
Open Live Script

```
[p,e,t] = initmesh('lshapeg');
[p,e,t] = refinemesh('lshapeg',p,e,t);
pdemesh(p,e,t)
```



Now solve Poisson's equation $-\Delta u = 1$ over the geometry defined by the L-shaped membrane. Use Dirichlet boundary conditions $u = 0$ on $\delta\Omega$, and plot the result.

```
u = assempde('lshapeb',p,e,t,1,0,1);
pdemesh(p,e,t,u)
```



Input Arguments

collapse all

`model` — Model object

`PDEModel` object | `ThermalModel` object | `StructuralModel` object | `ElectromagneticModel` object

Model object, specified as a `PDEModel` object, `ThermalModel` object, `StructuralModel` object, or `ElectromagneticModel` object.

Example: `model = createpde(3)`

Example: `thermalmodel = createpde('thermal','steadystate')`

Example: `structuralmodel = createpde('structural','static-solid')`

Example: `emagmodel = createpde('electromagnetic','electrostatic')`

`u` — PDE solution

vector | matrix

PDE solution, specified as a vector or matrix.

Example: `results = solvepde(model); u = results.NodalSolution;` or `u = assempde(model,c,a,f);`

`mesh` — Mesh object

`Mesh` property of a `PDEModel` object | output of `generateMesh`

Mesh object, specified as the `Mesh` property of a `PDEModel` object or as the output of `generateMesh`.

Example: `model.Mesh`

`nodes` — Nodal coordinates

2-by-*NumNodes* matrix | 3-by-*NumNodes* matrix

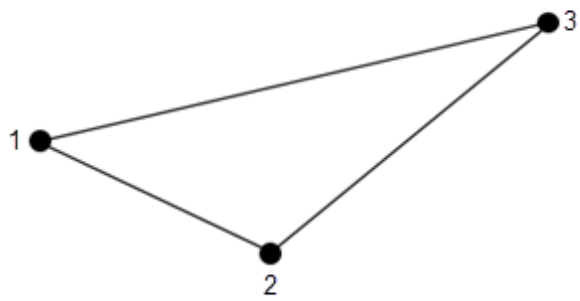
Nodal coordinates, specified as a 2-by-*NumNodes* matrix for a 2-D mesh and 3-by-*NumNodes* matrix for a 3-D mesh. *NumNodes* is the number of nodes.

`elements` — Element connectivity matrix in terms of node IDs

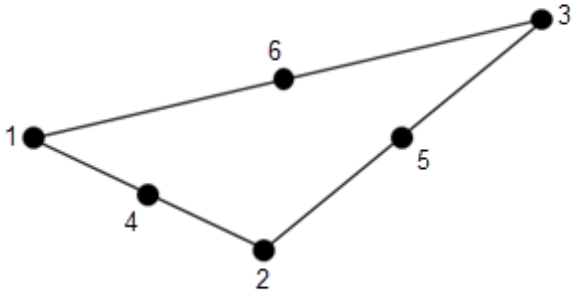
NodesPerElem-by-*NumElements* matrix

Element connectivity matrix in terms of node IDs, specified as an *NodesPerElem*-by-*NumElements* matrix. *NodesPerElem* is the number of nodes per element. Linear meshes contain only corner nodes, so there are three nodes per a 2-D element and four nodes per a 3-D element. Quadratic

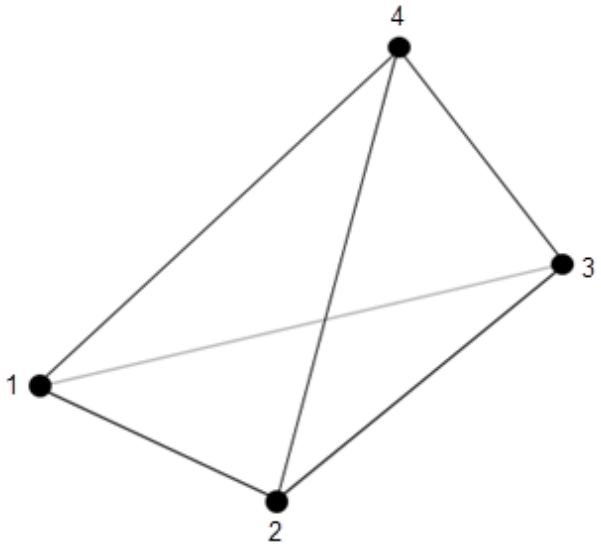
meshes contain corner nodes and nodes in the middle of each edge of an element. For quadratic meshes, there are six nodes per a 2-D element and 10 nodes per a 3-D element.



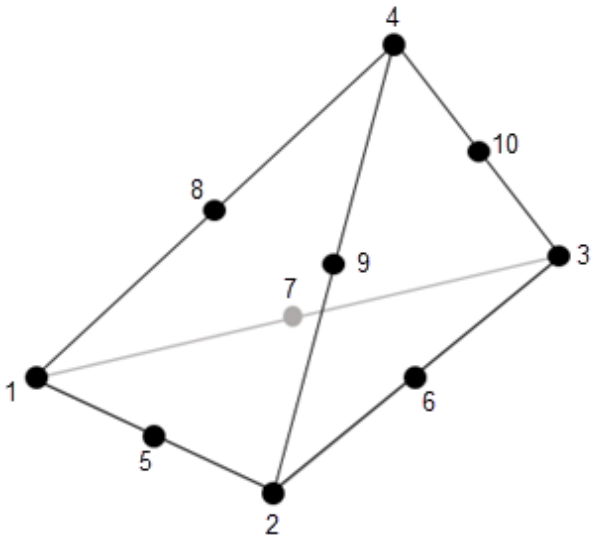
2-D linear element
showing node numbering



2-D quadratic element
showing node numbering



3-D linear element
showing node numbering



3-D quadratic element
showing node numbering

p — Mesh points

matrix

Mesh points, specified as a 2-by-`Np` matrix of points, where `Np` is the number of points in the mesh. For a description of the (`p`,`e`,`t`) matrices, see Mesh Data as [p,e,t] Triples.

Typically, you use the `p`, `e`, and `t` data exported from the **PDE Modeler** app, or generated by `initmesh` or `refinemesh`.

Example: `[p,e,t] = initmesh(gd)`

Data Types: `double`

e — Mesh edges

matrix

Mesh edges, specified as a `7`-by-`Ne` matrix of edges, where `Ne` is the number of edges in the mesh. For a description of the (`p`,`e`,`t`) matrices, see Mesh Data as [p,e,t] Triples.

Typically, you use the `p`, `e`, and `t` data exported from the **PDE Modeler** app, or generated by `initmesh` or `refinemesh`.

Example: `[p,e,t] = initmesh(gd)`

Data Types: `double`

`t` — Mesh triangles

matrix

Mesh triangles, specified as a `4`-by-`Nt` matrix of triangles, where `Nt` is the number of triangles in the mesh. For a description of the (`p`,`e`,`t`) matrices, see Mesh Data as [p,e,t] Triples.

Typically, you use the `p`, `e`, and `t` data exported from the **PDE Modeler** app, or generated by `initmesh` or `refinemesh`.

Example: `[p,e,t] = initmesh(gd)`

Data Types: `double`

Name-Value Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `pdemesh(model,'NodeLabels','on')`

`NodeLabels` — Node labels

`'off'` (default) | `'on'`

Node labels, specified as the comma-separated pair consisting of `'NodeLabels'` and `'off'` or `'on'`.

`pdemesh` ignores `NodeLabels` when you plot solution data as a 3-D plot.

Example: `'NodeLabels','on'`

Data Types: `char` | `string`

`ElementLabels` — Element labels

`'off'` (default) | `'on'`

Element labels, specified as the comma-separated pair consisting of `'ElementLabels'` and `'off'` or `'on'`.

`pdemesh` ignores `ElementLabels` when you plot solution data as a 3-D plot.

Example: `'ElementLabels','on'`

Data Types: `char` | `string`

`FaceAlpha` — Surface transparency for 3-D geometry

`1` (default) | real number from `0` through `1`

Surface transparency for 3-D geometry, specified as the comma-separated pair consisting of `'FaceAlpha'` and a real number from `0` through `1`. The default value `1` indicates no transparency. The value `0` indicates complete transparency.

Example: `'FaceAlpha',0.5`

Data Types: `double`

`EdgeColor` — Color of mesh edges

short color name | long color name | RGB triplet

Color of mesh edges, specified as a short or long color name or an RGB triplet. By default, for 2-D meshes the edges within one face are blue (RGB triplet `[0 0 1]`) and the edges between faces are red (RGB triplet `[1 0 0]`). For 3-D meshes, the default edge color is black (RGB triplet `[0 0 0]`).

The short names and long names are character vectors that specify one of eight predefined colors. The RGB triplet is a three-element row vector whose elements specify the intensities of the red, green, and blue components of the color; the intensities must be in the range [0 1]. The following table lists the predefined colors and their RGB triplet equivalents.

RGB Triplet	Short Name	Long Name
`[1 1 0]`	`y`	`yellow`
`[1 0 1]`	`m`	`magenta`
`[0 1 1]`	`c`	`cyan`
`[1 0 0]`	`r`	`red`
`[0 1 0]`	`g`	`green`
`[0 0 1]`	`b`	`blue`
`[1 1 1]`	`w`	`white`
`[0 0 0]`	`k`	`black`

Example: `'EdgeColor','green'`

Data Types: `double` | `char` | `string`

`FaceColor` — Color of mesh faces for 3-D meshes

`[0 1 1]` | short color name | long color name | RGB triplet

Color of mesh faces for 3-D meshes, specified as a short or long color name or an RGB triplet. The default face color is cyan (RGB triplet `[0 1 1]`). For details about available colors, see EdgeColor.

Example: `'FaceColor','green'`

Data Types: `double` | `char` | `string`

Output Arguments

collapse all

`h` — Handles to graphics objects

vector

Handles to graphics objects, returned as a vector.

See Also

`pdeplot` | `pdeplot3D` | `pdegplot`

Topics

Mesh Data

Introduced before R2006a