fc graphics4mesh Octave package, User's Guide[*]

version 0.1.3

François Cuvelier[†]

March 19, 2020

Abstract

This Octave package allows to display simplicial meshes or datas on simplicial meshes. A simplicial mesh must be given by two arrays : the vertices array and the connectivity array.

0 Contents

[*]LaTeX manual, revision 0.1.3, compiled with Octave 5.2.0, and packages `fc-graphics4mesh`[0.1.3], `fc-tools`[0.0.31], `fc-bench`[0.1.2], `fc-amat`[0.1.2], `fc-meshtools`[0.1.3]

[†]LAGA, UMR 7539, CNRS, Université Paris 13 - Sorbonne Paris Cité, Université Paris 8, 99 Avenue J-B Clément, F-93430 Villetaneuse, France, cuvelier@math.univ-paris13.fr.

This work was supported by the ANR project DEDALES under grant ANR-14-CE23-0005.

1 Introduction

The **experimental** Octave package uses internal functions for displaying simplicial meshes or datas on simplicial meshes. Simplicial meshes could be:

- a triangular mesh in dimension 2, made with 2-simplices (ie. triangles),
- a tetrahedral mesh in dimension 3, made with 3-simplices (ie. tetrahedron),
- a triangular mesh in dimension 3 (surface mesh), made with 2-simplices,
- a line mesh in dimension 2 or 3 made with 1-simplices (ie. lines).

A simplicial mesh is given by its vertices array q and its connectivity array me . For demonstration purpose, some simplicial meshes are given in this package. They can be load by using the function getMesh2D, getMesh3D or getMesh3Ds of the fc_graphics4mesh package.

This package was tested on various OS with Octave releases:

Operating system	**4.4.0**	**4.4.1**	**5.1.0**	**5.2.0**
CentOS 7.7.1908	✓	✓	✓	✓
Debian 9.11	✓	✓	✓	✓
Fedora 29	✓	✓	✓	✓
OpenSUSE Leap 15.0	✓	✓	✓	✓
Ubuntu 18.04.3 LTS	✓	✓	✓	✓
MacOS High Sierra 10.13.6		✓	✓	✓
MacOS Mojave 10.14.4		✓	✓	✓
MacOS Catalina 10.15.2		✓	✓	✓
Windows 10 (1909)	✓	✓	✓	✓

It is not compatible with Octave releases prior to 4.2.0. Here are the links used to install the Octave releases tested:

- **Linux :** sources from `https://www.gnu.org/software/octave/`;

- **MacOS :** release 4.4.1 installed with dmg file from `http://octave-app.org/Download.html`, releases 5.1.0 and 5.2.0 installed with Homebrew;
- **Windows :** binaries from `https://www.gnu.org/software/octave/`.

2 Installation

2.1 Installation automatic, all in one

For this method, one just have to get/download the install file

ofc_graphics4mesh_install.m

or get it on the dedicated web page. Thereafter, one run it under Octave. This command download, extract and configure the fc graphics4mesh package and all the required packages in the current directory.

For example, on a Linux computer, to install this package in directory `~/Octave` one can do in a terminal:

```
mkdir -p ~/Octave
cd ~/Octave
HTTP=http://www.math.univ-paris13.fr/~cuvelier/software/codes/Octave
wget $HTTP/fc-graphics4mesh/0.1.1/ofc_graphics4mesh_install.m
```

Then in a Octave terminal run the following commands

```
>> cd ~/Octave
>> ofc_graphics4mesh_install
```

There is the output of the `ofc_graphics4mesh_install` command:

```
Parts of the <fc-graphics4mesh> Octave package.
Copyright (C) 2017-2020 F. Cuvelier

1- Downloading and extracting the packages
2- Setting the <fc-graphics4mesh> package
Write in ...
     ~/Octave/fc-graphics4mesh-full/fc_graphics4mesh-0.1.3/configure_loc.m ...
     ...
3- Using packages :
   ->              fc-tools : 0.0.31
   ->              fc-bench : 0.1.2
   ->               fc-amat : 0.1.2
   ->          fc-meshtools : 0.1.3
 with      fc-graphics4mesh : 0.1.3
*** Using instructions
   To use the <fc-graphics4mesh> package:
   addpath('~/Octave/fc-graphics4mesh-full/fc_graphics4mesh-0.1.3')
   fc_graphics4mesh.init()

   See ~/Octave/ofc_graphics4mesh_set.m
```

The complete package (i.e. with all the other needed packages) is stored in the directory `~/Octave/fc-graphics4mesh-full` and, for each Octave session, one have to set the package by:

```
>> addpath('~/Octave/fc-graphics4mesh-full/ofc-graphics4mesh-0.1.1')
>> fc_graphics4mesh.init()
```

If it's the first time the `fc_graphics4mesh.init()` function is used, then its output is

```
Try to use default parameters!
 Use fc_tools.configure to configure.
Write in ...
    ~/Octave/fc-graphics4mesh-full/fc_tools-0.0.31/configure_loc.m ...
Try to use default parameters!
 Use fc_bench.configure to configure.
Write in ~/Octave/fc-graphics4mesh-full/fc_bench-0.1.2/configure_loc.m ...
    ...
Try to use default parameters!
 Use fc_amat.configure to configure.
Write in ~/Octave/fc-graphics4mesh-full/fc_amat-0.1.2/configure_loc.m ...
Try to use default parameters!
 Use fc_meshtools.configure to configure.
Write in ...
    ~/Octave/fc-graphics4mesh-full/fc_meshtools-0.1.3/configure_loc.m ...
Using fc_graphics4mesh[0.1.3] with fc_tools[0.0.31], fc_bench[0.1.2], ...
    fc_amat[0.1.2], fc_meshtools[0.1.3].
```

Otherwise, the output of the `fc_meshtools.init()` function is

```
Using fc_graphics4mesh[0.1.3] with fc_tools[0.0.31], fc_bench[0.1.2], ...
    fc_amat[0.1.2], fc_meshtools[0.1.3].
```

For **uninstalling**, one just have to delete directory `~/Octave/fc-graphics4mesh-full`

3 Mesh

The functions getMesh2D, getMesh3D and getMesh3Ds return a mesh vertices array q, a mesh elements connectivity array associated with the input argument d (simplex dimension) and the indices array toGlobal. The vertices array q is a dim-by-$\mathrm{n_q}$ array where dim is the space dimension (2 or 3) and $\mathrm{n_q}$ the number of vertices. The connectivity array me is a $(d+1)$-by-$\mathrm{n_{me}}$ array where $\mathrm{n_{me}}$ is the number of mesh elements and $0 \leqslant d \leqslant dim$ is the simplicial dimension:

- $d = 0$: points,
- $d = 1$: lines,
- $d = 2$: triangle,
- $d = 3$: tetrahedron.

So we can use theses functions to obtain

- 3D mesh: getMesh3D(3) (*main* mesh), getMesh3D(2), getMesh3D(1), getMesh3D(0),
- 3D surface mesh: getMesh3Ds(2) (*main* mesh), getMesh3Ds(1) , getMesh3Ds(0),
- 2D mesh: getMesh2D(2) (*main* mesh), getMesh2D(1), getMesh2D(0).

For example,

- [q3,me3,toGlobal3]=fc_meshtools.simplicial.getMesh3D(3) return a 3-simplicial mesh (main mesh) in space dimension $dim = 3$,
- [q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3D(2) return a 2-simplicial mesh in space dimension $dim = 3$.

The third output are indices of the vertices in the *main* mesh:
q3 (:, toGlobal2) == q2

4 fc_graphics4mesh.plotmesh function

The function fc_graphics4mesh.plotmesh displays a mesh given by

Syntaxe

```
fc_graphics4mesh.plotmesh(q,me)
fc_graphics4mesh.plotmesh(q,me,Name,Value,  ...)
```

Description

plotmesh(q,me) displays all the Th.d-dimensional simplices elements.

plotmesh(q,me,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'color' : to specify the color of the displayed mesh elements. (default : 'blue'),
- 'cutPlane' : (only for simplices in dimension 3) cut mesh by n planes given by n-by-4 array P where the equation of the i-th cut plane is given by

$$P(i,1)\,x + P(i,2)\,y + P(i,3)\,z + P(i,4) = 0.$$

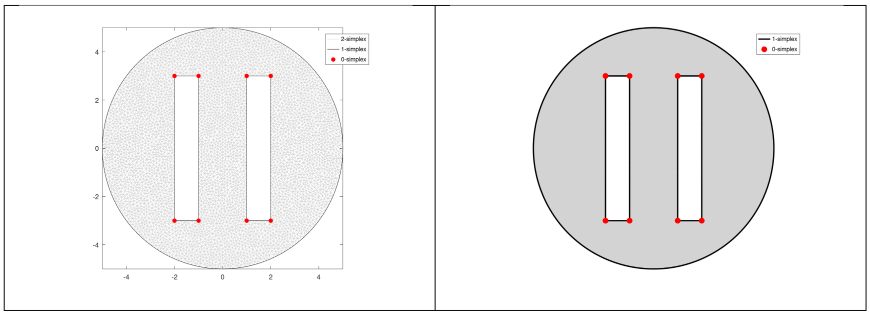
  The normal vector $P(i,1:3)$ pointed to the part of the mesh not displayed. default : [] (no cut).
- 'inLegend' : to add this mesh in a legend if true. Default is false.
- 'DisplayName' : to specify the name used in a legend for this mesh. Then the ('inLegend' option is forced to true.

The options of second level depend on the type of elementaries mesh elements to represent.
One can use any option of the following functions according to the type of d-simplex to be represented.

- In dimension 3,
  - if $d == 3$, **patch** function is used,
  - if $d == 2$, trimesh function is used,
  - if $d == 1$, **plot3** function is used,
  - if $d == 0$, **plot3** function is used,

- In dimension 2,
  - if $d == 2$, trimesh or patch function is used,
  - if $d == 1$, **plot** function is used,
  - if $d == 0$, **plot** function is used,
- In dimension 1,
  - if $d == 1$, **line** function is used,
  - if $d == 0$, **plot** function is used,

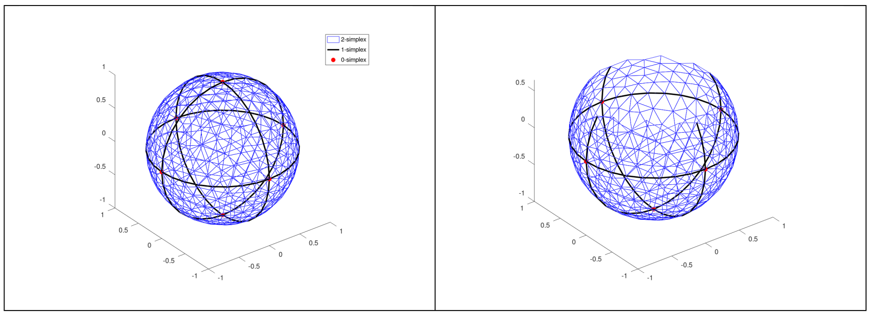
2D example : the following code is part of the `fc_graphics4mesh.demos.plotmesh2D` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh2D(2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh2D(1);
[q0,me0,toGlobal0]=fc_meshtools.simplicial.getMesh2D(0);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray','DisplayName','2-simplex')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black','DisplayName','1-simplex')
fc_graphics4mesh.plotmesh(q0,me0,'color','red','DisplayName','0-simplex')
axis image
legend show

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'fill',true,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black','Linewidth',2, ...
    'DisplayName','1-simplex')
fc_graphics4mesh.plotmesh(q0,me0,'color','red','markersize',8, ...
    'DisplayName','0-simplex')
axis image;axis off
```

Listing 1: Using fc_graphics4mesh.**plotmesh** function with a 2D mesh

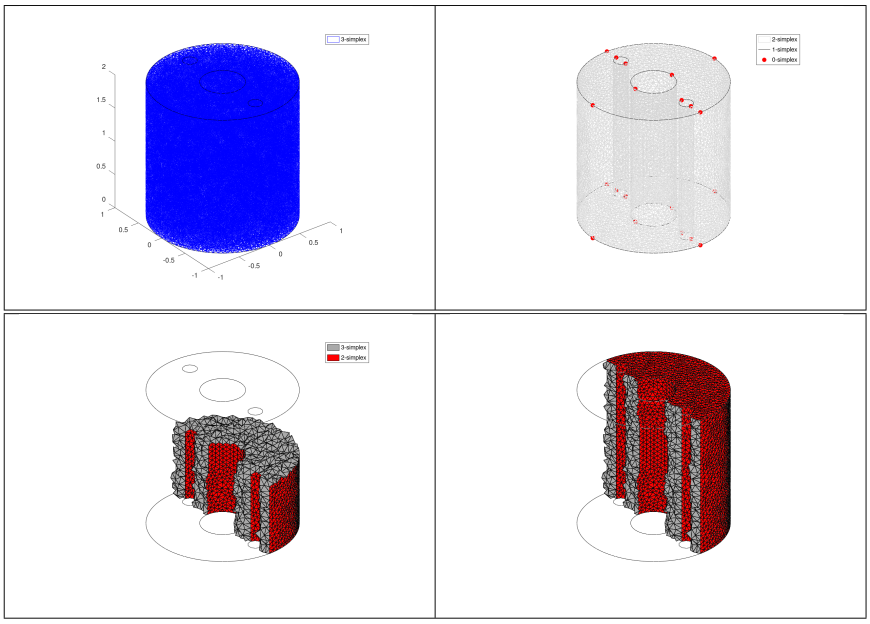
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plotmesh3Ds` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3Ds(2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh3Ds(1);
[q0,me0,toGlobal0]=fc_meshtools.simplicial.getMesh3Ds(0);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','blue','FaceColor','None', ...
     'DisplayName','2-simplex')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black', 'Linewidth',2, ...
     'DisplayName','1-simplex')
fc_graphics4mesh.plotmesh(q0,me0,'color','red','DisplayName','0-simplex')
view(3);axis image
legend show
P=fc_tools.graphics.PlaneCoefs([0 0 1/2], [0 0 1]);
figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','blue','FaceColor','None', ...
     'cutPlane',P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black', 'Linewidth',2,'cutPlane',P)
fc_graphics4mesh.plotmesh(q0,me0,'color','red','cutPlane',P)
```

Listing 2: Using fc_graphics4mesh.**plotmesh** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plotmesh3D` function.



```
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMesh3D(3);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3D(2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh3D(1);
[q0,me0,toGlobal0]=fc_meshtools.simplicial.getMesh3D(0);
figure(1)
view(3)
fc_graphics4mesh.plotmesh(q3,me3,'EdgeColor','blue','FaceColor','None', ...
     'DisplayName','3-simplex')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black')
axis image
legend show

figure(2)
view(3)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','LightGray','FaceColor','None', ...
     'DisplayName','2-simplex')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black','DisplayName','1-simplex')
fc_graphics4mesh.plotmesh(q0,me0,'color','red','DisplayName','0-simplex')
axis image;axis off
legend show

P=[fc_tools.graphics.PlaneCoefs([0 0 1], [0 0 1]); ...
    fc_tools.graphics.PlaneCoefs([0 0 1],[-1 0 0])];
figure(3)
view(3)
fc_graphics4mesh.plotmesh(q1,me1,'color','black')
hold on
fc_graphics4mesh.plotmesh(q3,me3,'cutPlane',P,'Color','DarkGrey', ...
     'DisplayName','3-simplex')
fc_graphics4mesh.plotmesh(q2,me2,'cutPlane',P,'Color','red', ...
     'DisplayName','2-simplex')
axis image;axis off
legend show

P=fc_tools.graphics.PlaneCoefs([0 0 1], [-1 0 0]);
figure(4)
view(3)
fc_graphics4mesh.plotmesh(q1,me1,'color','black')
hold on
fc_graphics4mesh.plotmesh(q3,me3,'cutPlane',P,'Color','DarkGrey')
fc_graphics4mesh.plotmesh(q2,me2,'cutPlane',P,'Color','red')
```

Listing 3: Using fc_graphics4mesh.**plotmesh** function with a 3D mesh

5 fc_graphics4mesh.plot function

The function fc_graphics4mesh.**plot** displays data on a mesh given by its vertices array q and its connectivity array me .

Syntax

```
fc_graphics4mesh.plot(q,me,u)
fc_graphics4mesh.plot(q,me,u,Name,Value, ...)
```

Description

plot(q,me,u) displays data u on a simplicial mesh. The data u can be an handle function or an array.

plot(q,me,u,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'cutPlane' : (only for simplices in dimension 3) cut mesh by n planes given by n-by-4 array P where the equation of the i-th cut plane is given by

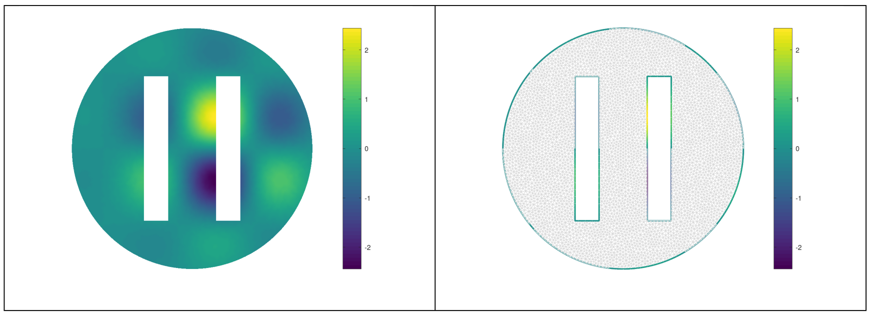
  $$P(i,1)\,x + P(i,2)\,y + P(i,3)\,z + P(i,4) = 0.$$

  The normal vector $P(i, 1:3)$ pointed to the part of the mesh not displayed. default : [] (no cut).

The options of second level depend on the type of elementaries mesh elements to represent.
One can use any option of the following functions according to the type of d-simplex to be represented.

- In dimension 3, **patch** function is used.
- In dimension 2,
  - if $d == 2$, **surf** or **patch** (option 'plane' to true) function is used,
  - if $d == 1$, **patch** function is used,
- In dimension 1, **plot** function is used.

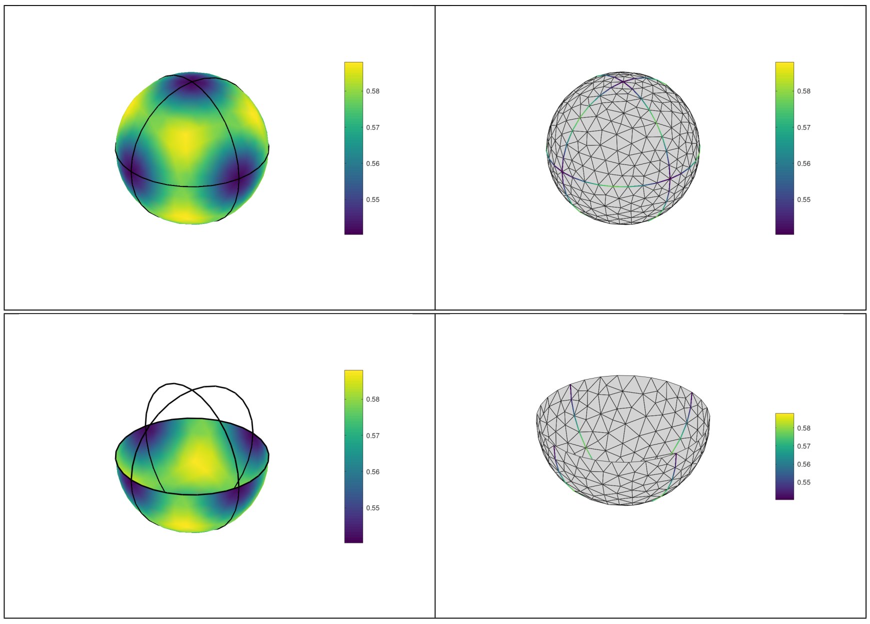
2D example : the following code is part of the `fc_graphics4mesh.demos.plot2D` function.



```
u=@(x,y) 3*exp(-((x-1).^2+y.^2)/10).*cos(x-1).*sin(y);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('2D',2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('2D',1);
U2=fc_meshtools.eval(u,q2);
figure(1)
fc_graphics4mesh.plot(q2,me2,U2,'plane',true)
shading interp
axis image;axis off
colorbar

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
hold on
fc_graphics4mesh.plot(q1,me1,u,'LineWidth',2)
caxis([min(U2) max(U2)])
axis image;axis off
```

Listing 4: Using fc_graphics4mesh.**plot** function with a 2D mesh

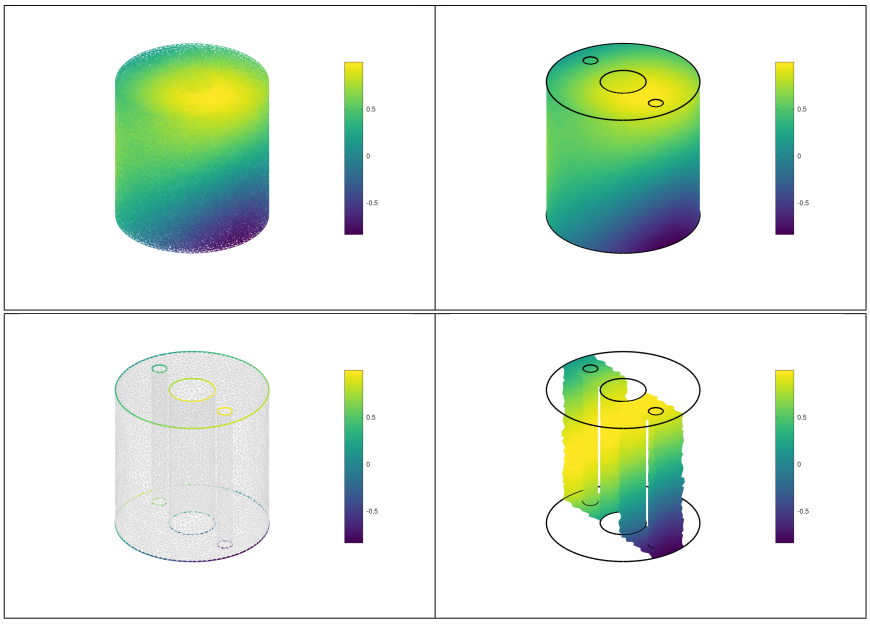
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plot3Ds` function.



```
u=@(x,y,z) cos(x).*cos(y).*cos(z);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3Ds(2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh3Ds(1);
U2=fc_meshtools.eval(u,q2);
U1=fc_meshtools.eval(u,q1);
figure(1)
fc_graphics4mesh.plot(q2,me2,U2)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k','LineWidth',2)
shading interp
view(3);axis image;axis off
colorbar
figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
hold on
fc_graphics4mesh.plot(q1,me1,U1,'LineWidth',2)
view(3);axis image;axis off
caxis([min(U2),max(U2)])
colorbar
P=fc_tools.graphics.PlaneCoefs([0 0 0], [0 0 1]);
figure(3)
fc_graphics4mesh.plot(q2,me2,U2,'cutPlane',P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k','LineWidth',2)
shading interp
view(3);axis image;axis off
caxis([min(U2),max(U2)])
colorbar
figure(4)
fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray','cutPlane',P)
hold on
fc_graphics4mesh.plot(q1,me1,U1,'LineWidth',2,'cutPlane',P)
view(3);axis image;axis off
caxis([min(U2),max(U2)])
```

Listing 5: Using fc_graphics4mesh.**plot** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plot3D` function.



```
u=@(x,y,z) cos(x).*sin(y+z);
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3);
U3=fc_meshtools.eval(u,q3);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3D',2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1);

figure(1)
fc_graphics4mesh.plot(q3,me3,U3)
shading interp
view(3);axis image;axis off
colorbar

figure(2)
fc_graphics4mesh.plot(q2,me2,U3(toGlobal2))
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black','LineWidth',2)
shading interp
view(3);axis image;axis off
caxis([min(U3),max(U3)])
colorbar

figure(3)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','LightGray','FaceColor','None')
hold on
fc_graphics4mesh.plot(q1,me1,u,'LineWidth',2)
view(3);axis image;axis off
caxis([min(U3),max(U3)])
colorbar

P=[fc_tools.graphics.PlaneCoefs([0.2 0 1], [1 0 ...
     0]);fc_tools.graphics.PlaneCoefs([-0.2 0 1], [-1 0 0])];
figure(4)
fc_graphics4mesh.plot(q2,me2,U3(toGlobal2),'cutPlane',P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','black','LineWidth',2)
shading interp
view(3);axis image;axis off
caxis([min(U3),max(U3)])
```

Listing 6: Using fc_graphics4mesh.**plot** function with a 3D mesh

6 fc_graphics4mesh.plotiso function

The function fc_graphics4mesh.**plot** displays isolines from datas on a 2-simplicial mesh given by its vertices array q and its connectivity array me.

Syntax

```
fc_graphics4mesh.plotiso(q,me,u)
fc_graphics4mesh.plotiso(q,me,u,Name,Value, ...)
```

Description

plotiso (q,me,u) displays isolines from datas on the 2-simplicial mesh given by the vertices array q and the connectivity array me. The data u can be an handle function or an array.

plotiso (q,me,u,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'niso' : to specify the number of isolines (default : 10)
- 'isorange' : to specify the list of isovalues (default : empty)
- 'isocolorbar' : if true, colorbar with isovalues is drawn (default : false)
- 'format' : to specify the format of the isovalues on the colorbar (default : '%g')
- 'plane' : if true, isolines are in the xy-plane, otherwise isolines are in 3D with z-value set to u (default : false)
- 'color' : to specify one color for all isolines (default : empty)

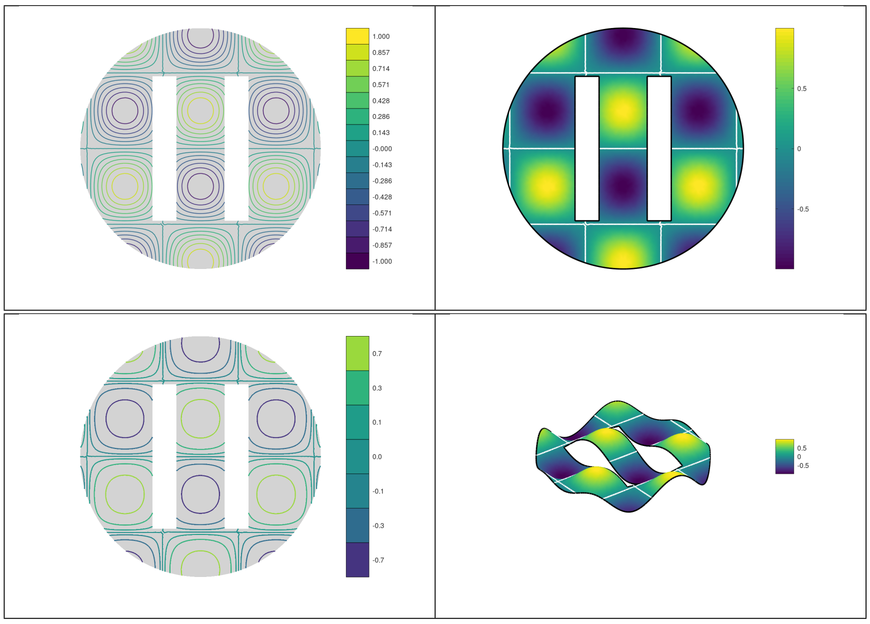
The options of second level are all options of

- **plot3** function in dimension 3 or in dimension 2 with 'plane' option set to false
- **plot** function in 2 with 'plane' option set to true

This function accepts until 3 output arguments :

- 1st output is the colors of the isolines
- 2nd output is the isovalues of the isolines
- 3th output is all the handles of the isolines as an 2D-array of dimension N-by-niso, where N is the number of 2-simplex elementary meshes where isolines are drawn.

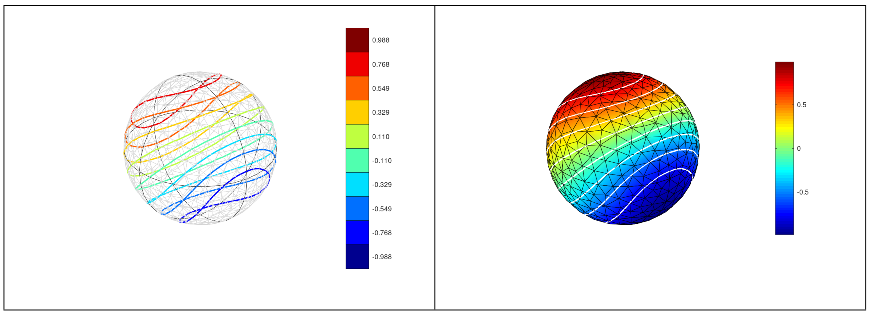
2D example : the following code is part of the `fc_graphics4mesh.demos.plotiso2D` function.



```
u=@(x,y) cos(x).*sin(y);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh2D(2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh2D(1);
U2=fc_meshtools.eval(u,q2);
U1=fc_meshtools.eval(u,q1);

figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray','fill',true, ...
    'EdgeColor','None','FaceColor','LightGray')
hold on
fc_graphics4mesh.plotiso(q2,me2,U2,'plane',true, ...
    'niso',15,'isocolorbar',true,'format','%.3f','LineWidth',1)
axis image;axis off

figure(2)
fc_graphics4mesh.plot(q2,me2,U2,'plane',true)
hold on
fc_graphics4mesh.plotiso(q2,me2,U2,'plane',true, ...
    'Color','w','isorange',0,'LineWidth',2)
fc_graphics4mesh.plotmesh(q1,me1, 'LineWidth',2, 'Color','k')
colorbar
shading interp
axis image;axis off

figure(3)
fc_graphics4mesh.plotmesh(q2,me2,'z',U2,'fill',true,'Color','LightGray')
hold on
isorange=[-0.7,-0.3,-0.1,0,0.1,0.3,0.7];
fc_graphics4mesh.plotiso(q2,me2,U2,'LineWidth',2, ...
    'isorange',isorange,'isocolorbar',true,'format','%.1f')
axis image;axis off
figure(4)
fc_graphics4mesh.plot(q2,me2,U2)
hold on
fc_graphics4mesh.plotiso(q2,me2,U2,'LineWidth',2, ...
    'Color','w','isorange',0,'LineWidth',2)
fc_graphics4mesh.plotmesh(q1,me1,'z',U1,'LineWidth',2, 'Color','k')
axis image;axis off
shading interp
```

Listing 7: Using fc_graphics4mesh.**plotiso** function with a 2D mesh

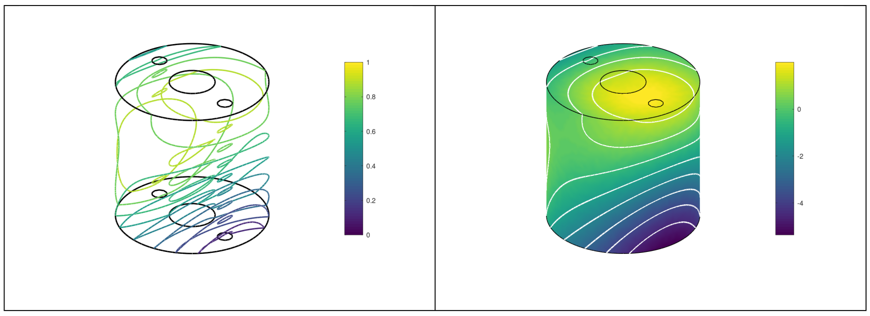
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plotiso3Ds` function.



```
u=@(x,y,z) cos(x).*sin(y+z);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3Ds',2);
U2=fc_meshtools.eval(u,q2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3Ds',1);
figure(1)
colormap('jet')
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','LightGray','FaceColor','None')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','black')
fc_graphics4mesh.plotiso(q2,me2,U2,'isocolorbar',true,'format','%.3f', ...
    'LineWidth',2)
view(3);axis image;axis off

figure(2)
colormap('jet')
fc_graphics4mesh.plot(q2,me2,U2)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','black')
fc_graphics4mesh.plotiso(q2,me2,U2,'LineWidth',2,'Color','w')
colorbar
```

Listing 8: Using fc_graphics4mesh.**plotiso** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plotiso3D` function.



```
u=@(x,y,z) -2+4*cos(x).*sin(y+z);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3D',2);
U2=fc_meshtools.eval(u,q2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1);
U1=fc_meshtools.eval(u,q1);
figure(1)
fc_graphics4mesh.plotmesh(q1,me1,'color','black','LineWidth',2)
hold on
fc_graphics4mesh.plotiso(q2,me2,U2,'LineWidth',2)
colorbar
shading interp
view(3);axis image;axis off
figure(2)
fc_graphics4mesh.plot(q2,me2,U2)
hold on
fc_graphics4mesh.plotiso(q2,me2,U2,'color','white','LineWidth',2)
fc_graphics4mesh.plotmesh(q1,me1,'color','black','LineWidth',1)
shading interp
view(3);axis image;axis off
```

Listing 9: Using fc_graphics4mesh.**plotiso** function with a 3D mesh

7 fc_graphics4mesh.slicemesh function

The fc_graphics4mesh.slicemesh function displays intersection of a plane and a 3D mesh given by its vertices array q and its connectivity array me .

Syntaxe

```
fc_graphics4mesh.slicemesh(q,me,P)
fc_graphics4mesh.slicemesh(q,me,P,Name,Value, ...)
```

Description

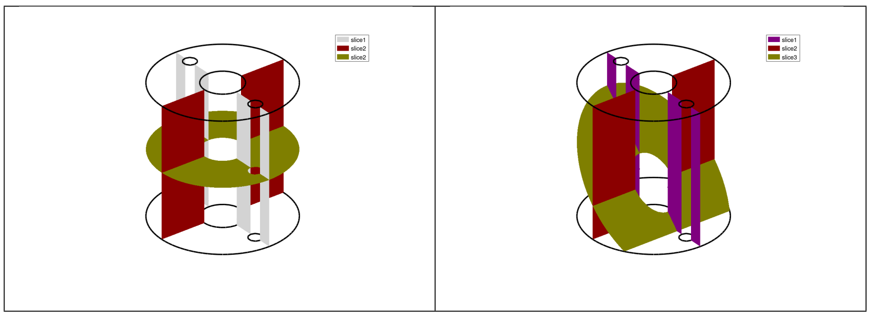
slicemesh(q,me,P) displays intersection of the plane defined by $P(1)x+P(2)y+P(3)z+P(4)=0$ and all the 3-dimensional simplices elements given by q and me arrays. To compute P one can use the fc_tools.graphics.PlaneCoefs function of the FC-TOOLS package. The 1-by-4 array P, is obtained with P=fc_tools.graphicsPlaneCoefs(Q,V) where Q is a point in the plane and V is a vector orthogonal to it. One can also used a n-by-4 array P where each line define a plane.

slicemesh(q,me,P,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'color' : to specify the slice color (default : 'LightGray', rgb =[0.9,0.9,0.9])

The options of second level are all options of the **patch** function except 'FaceColor' and 'EdgeColor'

3D example : the following code is part of the `fc_graphics4mesh.demos.slicemesh3D` function.



```
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1);
figure(1)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[1 0 0]);% ...
fc_graphics4mesh.slicemesh(q3,me3,P,'DisplayName','slice1')
hold on
P=fc_tools.graphics.PlaneCoefs([0 0 1],[0 1 0]);% ...
fc_graphics4mesh.slicemesh(q3,me3,P,'Color','DarkRed','DisplayName','slice2')
P=fc_tools.graphics.PlaneCoefs([0 0 1],[0 0 1]);% ...
fc_graphics4mesh.slicemesh(q3,me3,P,'Color','Olive','DisplayName','slice2')
fc_graphics4mesh.plotmesh(q1,me1,'color','k', 'LineWidth',2)
view(3);axis off; axis image
legend('show')
figure(2)
P=[fc_tools.graphics.PlaneCoefs([0 0 1/2],[1 0 0]); ...
   fc_tools.graphics.PlaneCoefs([0 0 1/2],[0 1 0]); ...
   fc_tools.graphics.PlaneCoefs([0 0 1/2],[0 -1 1])];
fc_graphics4mesh.slicemesh(q3,me3,P, 'Color',{'Purple','DarkRed','Olive'}, ...
    'DisplayName',{'slice1','slice2','slice3'})
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k', 'LineWidth',2)
view(3);axis off; axis image
```

Listing 10: Using fc_graphics4mesh.**slicemesh** function with a 3D mesh

8 `fc_graphics4mesh.slice` function

The fc_graphics4mesh.**slice** function displays intersection of a plane and a 3D mesh given by its vertices array q and its connectivity array me.

Syntaxe

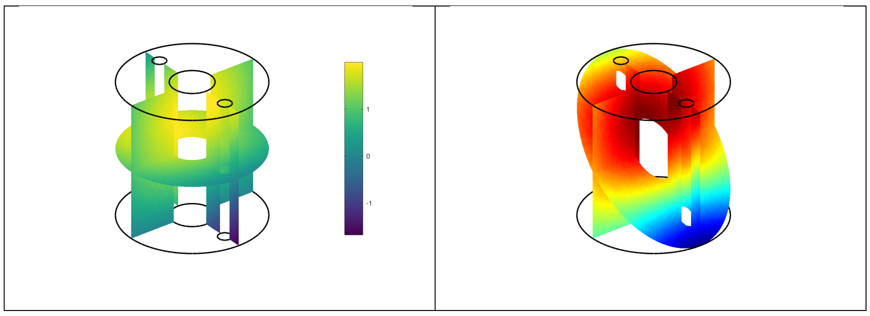
```
fc_graphics4mesh.slice(q,me,u,P)
fc_graphics4mesh.slice(q,me,u,P,Name,Value, ...)
```

Description

slice(q,me,u,P) displays data on the intersection of the plane defined by $P(1)x + P(2)y + P(3)z + P(4) = 0$ and all the 3-dimensional simplices elements given by q and me arrays. To compute P one can use the fc_tools.graphics.PlaneCoefs function of the FC-TOOLS package. The array P, is obtained with P=fc_tools.graphicsPlaneCoefs(Q,V) where Q is a point in the plane and V is a vector orthogonal to it. One can also used a n-by-4 array P where each line define a plane.

slice(q,me,u,P,Name,Value, ...) specifies function options using one or more Name,Value pair arguments which are those of the **patch** function excepts 'FaceColor' and 'EdgeColor'.

3D example : the following code is part of the `fc_graphics4mesh.demos.slice3D` function.



```
u=@(x,y,z) 2*cos(x).*sin(y+z);
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3);
U3=fc_meshtools.eval(u,q3);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1);

figure(1)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[1 0 0]);
fc_graphics4mesh.slicemesh(q3,me3,P)
hold on
fc_graphics4mesh.slice(q3,me3,U3,P)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[0 1 0]);
fc_graphics4mesh.slice(q3,me3,U3,P)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[0 0 1]);% ...
fc_graphics4mesh.slice(q3,me3,U3,P)
fc_graphics4mesh.plotmesh(q1,me1,'color','k', 'LineWidth',2)
view(3);axis off; axis image
colorbar

figure(2)
P=[fc_tools.graphics.PlaneCoefs([0 0 1],[1 0 0]); ...
   fc_tools.graphics.PlaneCoefs([0 0 1],[0 1 0]); ...
   fc_tools.graphics.PlaneCoefs([0 0 1],[0 -1 1])];
colormap('jet')
fc_graphics4mesh.slice(q3,me3,u,P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k', 'LineWidth',2)
```

Listing 11: Using fc_graphics4mesh.**slice** function with a 3D mesh

9 `fc_graphics4mesh.sliceiso` function

The fc_graphics4mesh.sliceiso function displays isolines of datas on the intersection of a plane and a 3D mesh given by its vertices array q and its connectivity array me.

Syntaxe

```
fc_graphics4mesh.sliceiso(q,me,u,P)
fc_graphics4mesh.sliceiso(q,me,u,P,Name,Value, ...)
```

Description

$\boxed{\text{sliceiso (q,me,u,P)}}$ displays isolines of data u on the intersection of the plane defined by $P(1)x + P(2)y + P(3)z + P(4) = 0$ and all the 3-dimensional simplices elements given by q and me arrays. To compute P one can use the fc_tools.graphics.PlaneCoefs function of the FC-TOOLS package. The 1-by-4 array P, is obtained with P=fc_tools.graphicsPlaneCoefs(Q,V) where Q is a point in the plane and V is a vector orthogonal to it. One can also used a n-by-4 array P where each line define a plane.

$\boxed{\text{sliceiso (q,me,u,P,Name,Value, ...)}}$ allows additional key/value pairs to be used when displaying u. The key strings could be

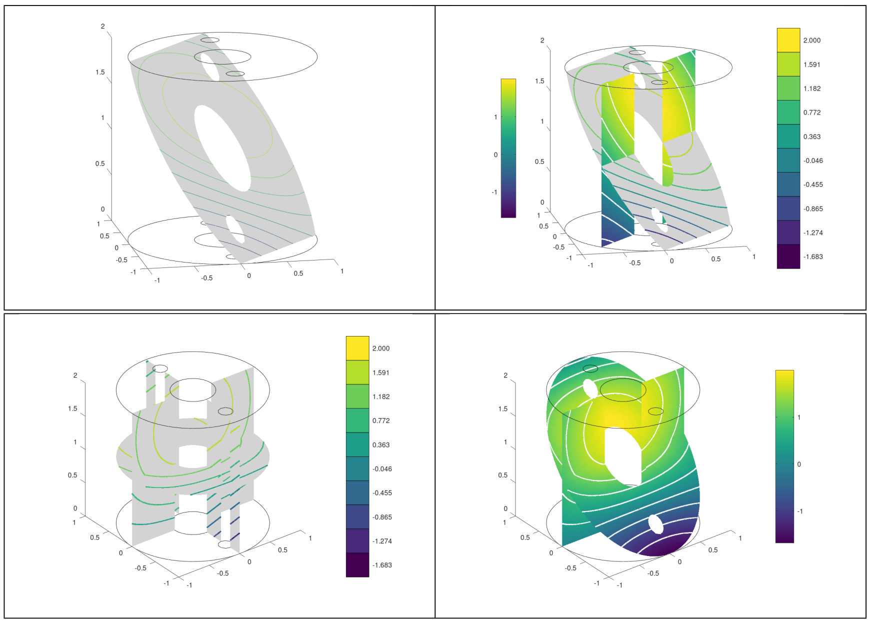
- 'niso' : to specify the number of isolines (default : 10)
- 'isorange' : to specify the list of isovalues (default : empty)
- 'color' : to specify one color for all isolines (default : empty)
- 'isocolorbar' : if true display a colorbar.Default is false.
- 'format' : to specify the format of the isovalues print in the colorbar. Default is `'%g'`.

For key strings, one could also used any options of the plot3 function.

This function accepts until 4 output arguments :

- 1st output is the colors of the isolines
- 2nd output is the isovalues of the isolines
- 3th output is the handle of the colobar iso.
- 4th output is all the handles of the isolines as an 2D-array of dimension N-by-niso, where N is the number of elementary meshes where isolines are drawn.

3D example : the following code is part of the `fc_graphics4mesh.demos.sliceiso3D` function.



```
u=@(x,y,z) 2*cos(x).*sin(y+z);
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3);
U3=fc_meshtools.eval(u,q3);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1);

figure(1)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[1 -1 1]);
fc_graphics4mesh.slicemesh(q3,me3,P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
fc_graphics4mesh.sliceiso(q3,me3,U3,P)
axis equal;axis image
view(-11,15)

figure(2)
P=fc_tools.graphics.PlaneCoefs([0 0 1],[1 -1 1]);
fc_graphics4mesh.slicemesh(q3,me3,P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
fc_graphics4mesh.sliceiso(q3,me3,U3,P,'Linewidth',2, ...
     'isocolorbar',true,'LineWidth',2,'format','%.3f');
P=fc_tools.graphics.PlaneCoefs([0 0 1],[1 -1 0]);
fc_graphics4mesh.slice(q3,me3,U3,P)
fc_graphics4mesh.sliceiso(q3,me3,U3,P,'color','w','Linewidth',2);
axis equal;axis image
colorbar('Location','westoutside')
caxis([min(U3),max(U3)])
view(-11,15)

figure(3)
P=[fc_tools.graphics.PlaneCoefs([0 0 1],[1 0 0]); ...
    fc_tools.graphics.PlaneCoefs([0 0 1],[0 1 0]); ...
    fc_tools.graphics.PlaneCoefs([0 0 1],[0 0 1])];
fc_graphics4mesh.slicemesh(q3,me3,P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
fc_graphics4mesh.sliceiso(q3,me3,U3,P,'isocolorbar',true,'LineWidth',2, ...
     'format','%.3f');
view(3);axis equal;axis image

figure(4)
P=[fc_tools.graphics.PlaneCoefs([0 0 1],[0 1 0]); ...
    fc_tools.graphics.PlaneCoefs([0 0 1],[0 -1 1])];
fc_graphics4mesh.slice(q3,me3,U3,P)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
fc_graphics4mesh.sliceiso(q3,me3,U3,P,'Color','w','LineWidth',2);
caxis([min(U3),max(U3)])
view(3);axis equal;axis image
```

Listing 12: Using fc_graphics4mesh.**sliceiso** function with a 3D mesh

10 `fc_graphics4mesh.plotquiver` function

The function fc_graphics4mesh.plotquiver displays vector field datas on a mesh given by its vertices array q and its connectivity array me .

Syntax

```
fc_graphics4mesh.plotquiver(q,me,V)
fc_graphics4mesh.plotquiver(q,me,V,Name,Value,  ...)
```

Description

plotquiver(q,me,V) displays vector field u on a simplicial mesh. The vector field data u can be a 1-by-dim cell arrays of handle functions or an dim-by-n_q array.

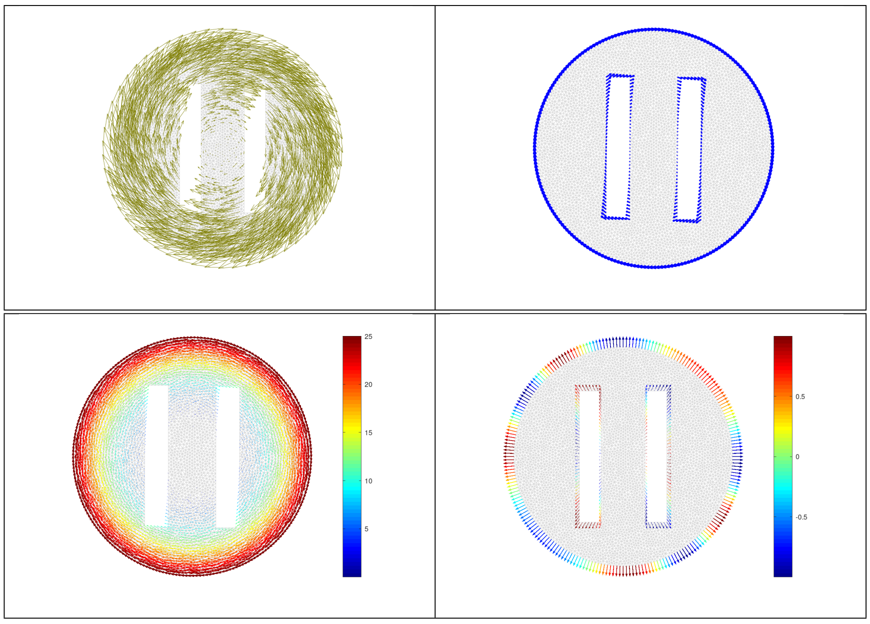
plotquiver(q,me,V,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'freq' : quiver frequencie, (default : 1)
- 'scale' : quiver scale, (default is fc_meshtools.getCharacteristicLength(q)/20)
- 'color' : set one color for all quivers (default: default color of the **quiver** or quiver3 functions). Cannot be used with 'colordata' option.
- 'colordata' : each quiver is colorized with a 1-by-nq array or a handle function (it will evaluated in all vertices) (default : empty).

The options of second level depend on the type of mesh elements to represent.
One can use any option of the following functions according to the type of d-simplex to be represented.

- In dimension 3 and with empty 'colordata' , the quiver3 function is used.
- In dimension 2 and with empty 'colordata' , the **quiver** function is used.
- In dimension 2 or 3 and with no empty 'colordata', the third party fc_tools.graphics.vfield3.vfield3 function is used.

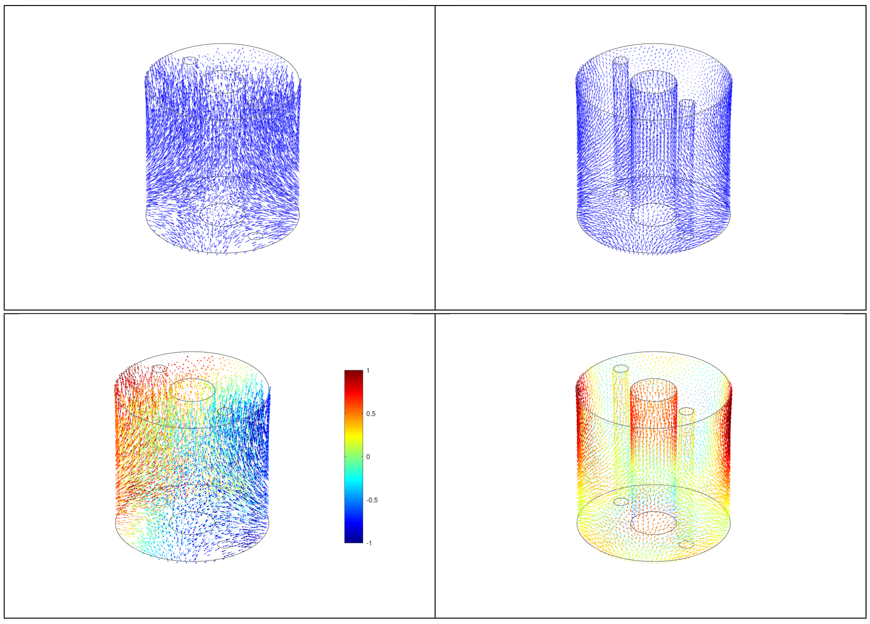
2D example



```
v={@(x,y) y.*sqrt(x.^2+y.^2),@(x,y) -x.*sqrt(x.^2+y.^2)};
  vv={@(x,y) x/5,@(x,y) y/5};
  [q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh2D(2); % Select small mesh
  V2=fc_meshtools.eval(v,q2);
  u2=sqrt(V2{1}.^2+V2{2}.^2);
  [q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh2D(1);
  V1=fc_meshtools.eval(v,q1);
  VV1=fc_meshtools.eval(vv,q1);
  u1=sqrt(V1{1}.^2+V1{2}.^2);
  figure(1)
  fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
  hold on
  fc_graphics4mesh.plotquiver(q2,me2,V2,  'color','Olive','freq',4,'scale',0.1)
  axis image;axis off
  figure(2)
  fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
  hold on
  fc_graphics4mesh.plotquiver(q1,me1,V1,'LineWidth',2)
  axis image;axis off
  figure(3)
  colormap('jet')
  fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
  hold on
  fc_graphics4mesh.plotquiver(q2,me2,V2,'colordata',u2)
  axis image;axis off
  colorbar
  figure(4)
  colormap('jet')
  fc_graphics4mesh.plotmesh(q2,me2,'color','LightGray')
  hold on
  fc_graphics4mesh.plotquiver(q1,me1,VV1,'LineWidth',2,'colordata',@(x,y) ...
      sin(x+y))
  axis image;axis off
  colorbar
```

Listing 13: Plot quiver on 2D mesh

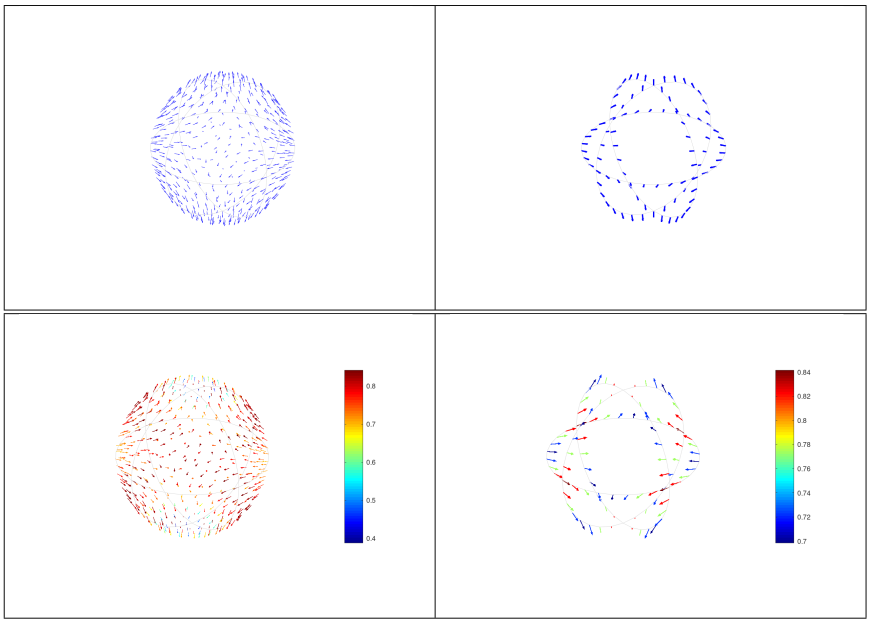
3D example



```
v={@(x,y,z) cos(x+z).*sin(y),@(x,y,z) sin(x).*cos(z+y),@(x,y,z) sin(z).*cos(x+y)};
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMesh3D(3);
V3=fc_meshtools.eval(v,q3);
fu3=@(x,y,z) y;
u3=fc_meshtools.eval(fu3,q3);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3D(2);
V2=fc_meshtools.eval(v,q2);
u2=sqrt(V2{1}.^2+V2{2}.^2+V2{3}.^2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh3D(1);
V1=fc_meshtools.eval(v,q1);
u1=sqrt(V1{1}.^2+V1{2}.^2+V1{3}.^2);
figure(1)
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q3,me3,V3,'freq',2)
figure(2)
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q2,me2,V2)
figure(3)
colormap('jet')
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q3,me3,V3,'colordata',u3, 'freq',2)
colorbar
figure(4)
colormap('jet')
fc_graphics4mesh.plotmesh(q1,me1,'color','k')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q2,me2,V2, 'colordata',u2)%,'scale',1)
```

Listing 14: Plot quivers on 3D mesh

3D surface example



```
v={@(x,y,z) cos(x+z).*sin(y),@(x,y,z) sin(x).*cos(z+y),@(x,y,z) sin(z).*cos(x+y)};
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMesh3Ds(2);
V2=fc_meshtools.eval(v,q2);
u2=sqrt(V2{1}.^2+V2{2}.^2+V2{3}.^2);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMesh3Ds(1);
V1=fc_meshtools.eval(v,q1);
u1=sqrt(V1{1}.^2+V1{2}.^2+V1{3}.^2);
figure(1)
fc_graphics4mesh.plotmesh(q1,me1,'color','LightGray')
hold on
fc_graphics4mesh.plotquiver(q2,me2,V2)
axis image;axis off
figure(2)
fc_graphics4mesh.plotmesh(q1,me1,'color','LightGray')
hold on
fc_graphics4mesh.plotquiver(q1,me1,V1,'LineWidth',2)
axis image;axis off
figure(3)
colormap('jet')
fc_graphics4mesh.plotmesh(q1,me1,'color','LightGray')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q2,me2,V2,'colordata',u2)
colorbar
figure(4)
colormap('jet')
fc_graphics4mesh.plotmesh(q1,me1,'color','LightGray')
hold on;axis image;axis off
fc_graphics4mesh.plotquiver(q1,me1,V1,'LineWidth',2,'colordata',u1, 'scale',0.2)
colorbar
```

Listing 15: 3D surface mesh : plotquiver function

11 fc_graphics4mesh.plotnodes function

The function fc_graphics4mesh.plotnodes displays the nodes of a given mesh nodes array

Syntaxe

```
fc_graphics4mesh.plotnodes(q)
fc_graphics4mesh.plotnodes(q,Name,Value, ...)
```

Description

plotnodes(q) displays all the nodes of the array q with a specific marker.

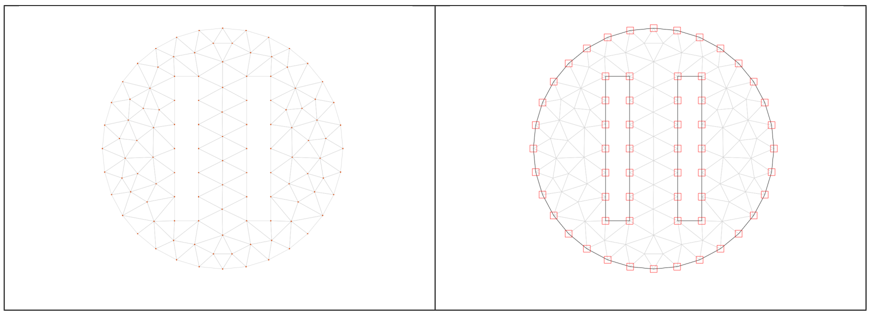
plotnodes(q,Name,Value, ...) specifies options using one or more Name,Value pair arguments. Options of first level are

- 'Marker' : to specify the marker (default : '.'),
- 'MarkerSize' : to specify the marker size (default : 6),
- 'idx' : to specify indices of the nodes to be displayed,

The options of second level depend on the dimension :

- if dimension 2, then options are those of the **plot** function,
- if dimension 3, then options are those of the **plot3** function.

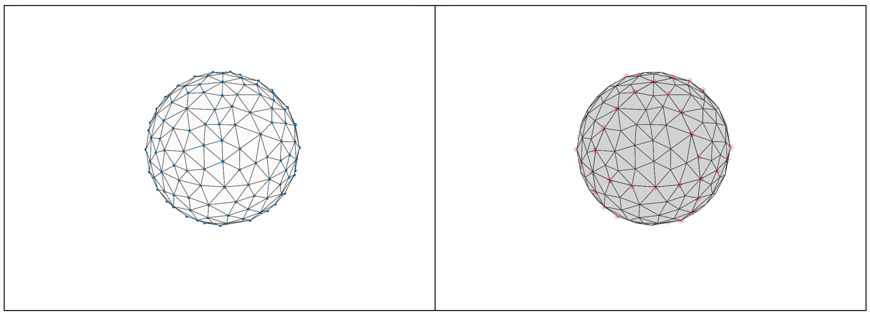
2D example : the following code is part of the `fc_graphics4mesh.demos.plotnodes2D` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('2D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('2D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotnodes(q2)
axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','k')
fc_graphics4mesh.plotnodes(q1,'Color','r','MarkerSize',10,'Marker','s')
```

Listing 16: Using fc_graphics4mesh.**plotnodes** function with a 2D mesh

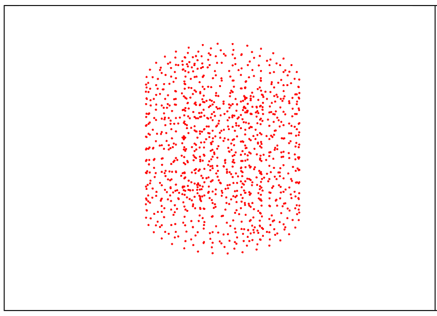
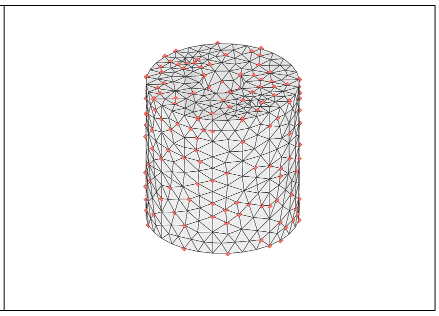
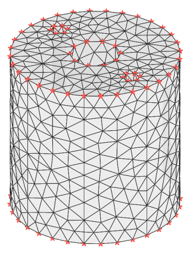
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plotnodes3Ds` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3Ds',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3Ds',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','k','FaceColor','LightGray', ...
    'FaceAlpha',0.1)
hold on
fc_graphics4mesh.plotnodes(q2,'MarkerSize',15)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','k')
fc_graphics4mesh.plotnodes(q1,'Color','r','MarkerSize',10,'Marker','*')
```

Listing 17: Using fc_graphics4mesh.**plotnodes** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plotnodes3D` function.

```
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3,true);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q3,me3,'EdgeColor','LightGray','EdgeAlpha',0.7, ...
    'FaceColor','None')
hold on
fc_graphics4mesh.plotnodes(q3,'Color','r','MarkerSize',10)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
idx=1:3:size(q2,2);
fc_graphics4mesh.plotnodes(q2,'idx',idx,'MarkerSize',8,'Marker','d', ...
    'MarkerEdgeColor', 'red','MarkerFaceColor','Salmon')
view(3);axis image;axis off

figure(3)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
fc_graphics4mesh.plotnodes(q1,'MarkerSize',8,'Marker','p', 'MarkerEdgeColor', ...
    'red','MarkerFaceColor','Salmon')
```

Listing 18: Using fc_graphics4mesh.**plotnodes** function with a 3D mesh

12 fc_graphics4mesh.plotnodesidx function

The function fc_graphics4mesh.plotnodesidx displays indices of the given mesh nodes array

Syntaxe

```
fc_graphics4mesh.plotnodesidx(q,)
fc_graphics4mesh.plotnodesidx(q,Name,Value, ...)
```

Description

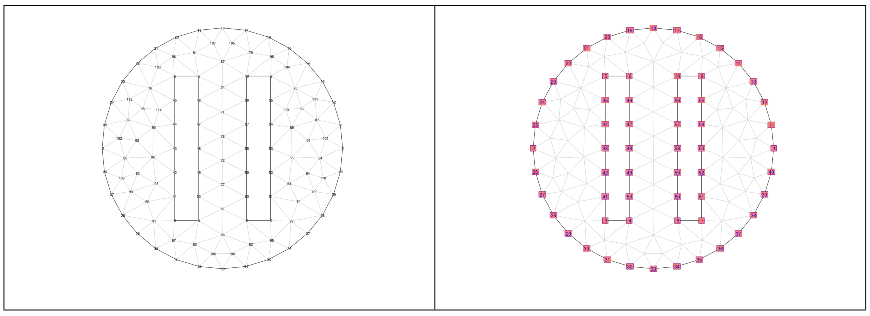
plotnodesidx(q) displays all the numbers/indices of the nodes array q

plotnodesidx(q,Name,Value, ...) specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'toGlobal' : to specify other indices to display,
- 'idx' : to select particular indices.

The options of second level are those of the **text** function.

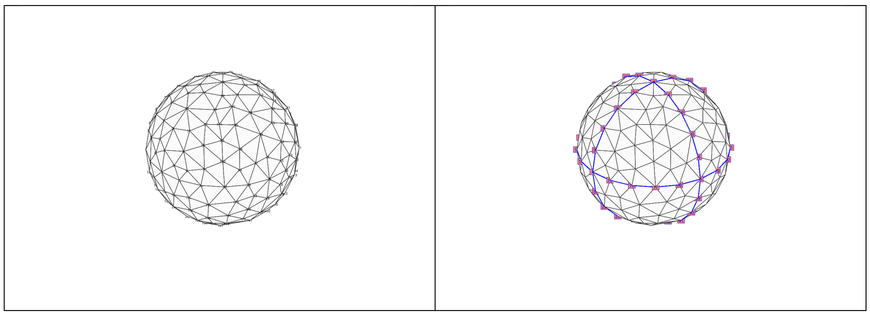
2D example : the following code is part of the `fc_graphics4mesh.demos.plotnodesidx2D` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('2D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('2D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','k')
fc_graphics4mesh.plotnodesidx(q2)
axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','k')
fc_graphics4mesh.plotnodesidx(q1,'Color','b', 'backgroundcolor','Salmon', ...
    'edgecolor','purple','fontsize',7)
```

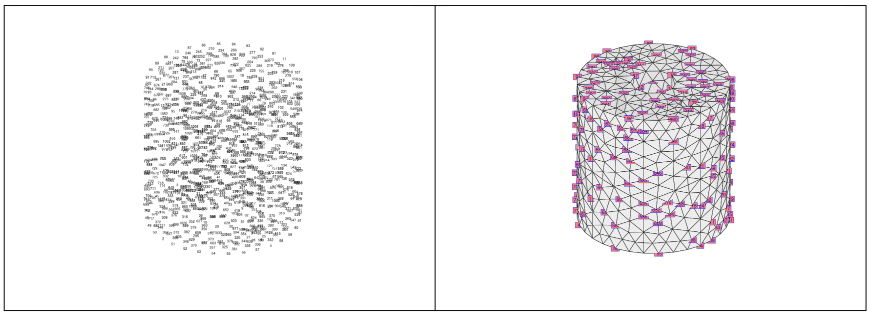
Listing 19: Using fc_graphics4mesh.**plotnodesidx** function with a 2D mesh

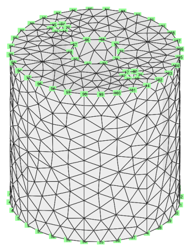
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plotnodesidx3Ds` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3Ds',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3Ds',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','k','FaceColor','LightGray', ...
    'FaceAlpha',0.1)
hold on
fc_graphics4mesh.plotnodesidx(q2)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray','FaceAlpha',0.1)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','b','linewidth',1.5)
fc_graphics4mesh.plotnodesidx(q1,'Color','b', 'backgroundcolor','Salmon', ...
    'edgecolor','b','fontsize',7)
```
Listing 20: Using fc_graphics4mesh.**plotnodesidx** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plotnodesidx3D` function.





```
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3,true);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q3,me3,'EdgeColor','LightGray','EdgeAlpha',0.7, ...
     'FaceColor','None')
hold on
fc_graphics4mesh.plotnodesidx(q3)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
idx=1:3:size(q2,2);
fc_graphics4mesh.plotnodesidx(q2,'idx',idx, 'Color','b', ...
     'backgroundcolor','Salmon', 'edgecolor','b','fontsize',7)
view(3);axis image;axis off

figure(3)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
fc_graphics4mesh.plotnodesidx(q1,'backgroundcolor','PaleGreen1')
```

Listing 21: Using fc_graphics4mesh.**plotnodesidx** function with a 3D mesh

13 fc_graphics4mesh.plotelementsidx function

The function fc_graphics4mesh.plotelementsidx displays indices of a given mesh connectivity array

Syntaxe

```
fc_graphics4mesh.plotelementsidx(q,me)
fc_graphics4mesh.plotelementsidx(q,me,Name,Value, ...
     ...)
```

Description

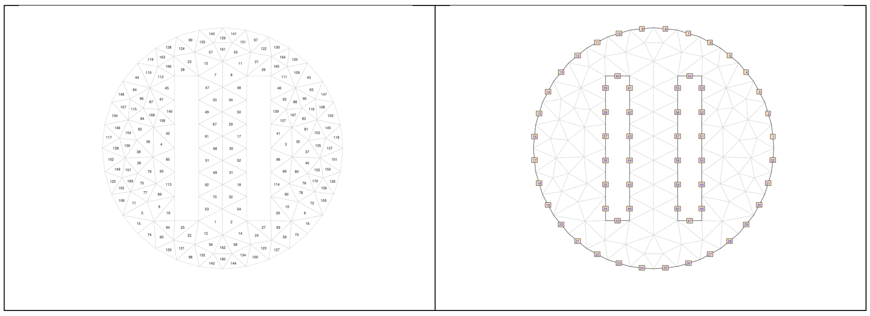
$\boxed{\text{plotelementsidx(q,me)}}$ displays all the numbers/indices of the connectivity array me.

$\boxed{\text{plotelementsidx(q,me,Name,Value, ...)}}$ specifies function options using one or more Name,Value pair arguments. Options of first level are

- 'toGlobal' : to specify other indices to display,
- 'idx' : to select particular indices.

The options of second level are those of the `text` function.

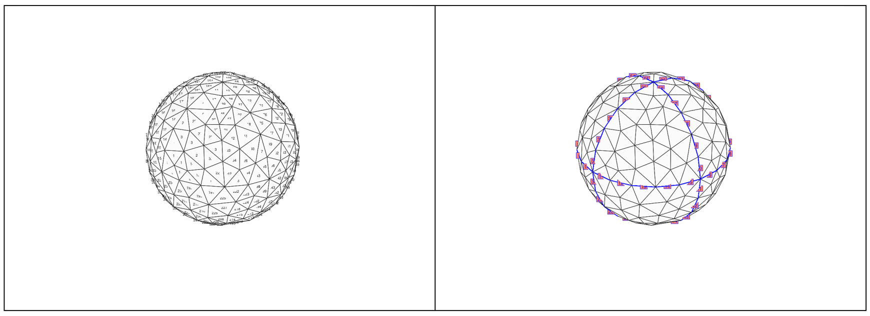
2D example : the following code is part of the `fc_graphics4mesh.demos.plotelementsidx2D` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('2D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('2D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotelementsidx(q2,me2)
axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray')
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','k')
fc_graphics4mesh.plotelementsidx(q1,me1,'Color','b', ...
     'BackgroundColor','Moccasin','FontSize',5,'edgecolor','k')
```

Listing 22: Using fc_graphics4mesh.**plotelementsidx** function with a 2D mesh

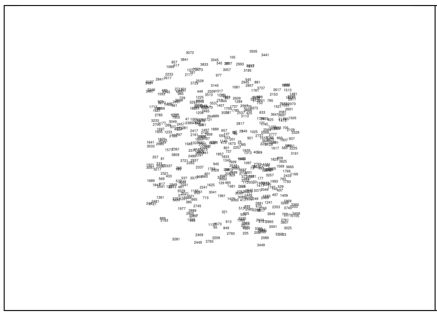
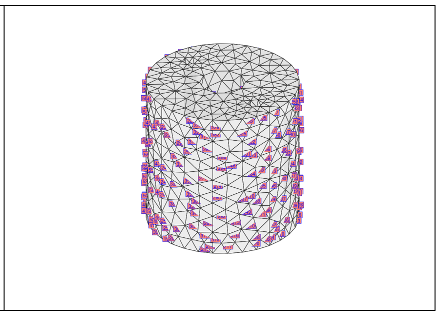
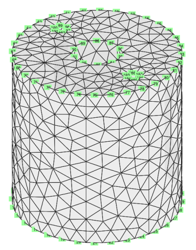
3Ds example : the following code is part of the `fc_graphics4mesh.demos.plotelementsidx3Ds` function.



```
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3Ds',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3Ds',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q2,me2,'EdgeColor','k','FaceColor','LightGray', ...
    'FaceAlpha',0.1)
hold on
fc_graphics4mesh.plotelementsidx(q2,me2)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'Color','LightGray','FaceAlpha',0.1)
hold on
fc_graphics4mesh.plotmesh(q1,me1,'Color','b','linewidth',1.5)
fc_graphics4mesh.plotelementsidx(q1,me1,'Color','b', ...
    'backgroundcolor','Salmon', 'edgecolor','b','fontsize',7)
```

Listing 23: Using fc_graphics4mesh.**plotelementsidx** function with a 3Ds mesh

3D example : the following code is part of the `fc_graphics4mesh.demos.plotelementsidx3D` function.

```
[q3,me3,toGlobal3]=fc_meshtools.simplicial.getMeshArrays('3D',3,true);
[q2,me2,toGlobal2]=fc_meshtools.simplicial.getMeshArrays('3D',2,true);
[q1,me1,toGlobal1]=fc_meshtools.simplicial.getMeshArrays('3D',1,true);
figure(1)
fc_graphics4mesh.plotmesh(q3,me3,'EdgeColor','LightGray','EdgeAlpha',0.7, ...
    'FaceColor','None')
hold on
idx=1:8:size(me3,2);
fc_graphics4mesh.plotelementsidx(q3,me3,'idx',idx)
view(3);axis image;axis off

figure(2)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
idx=1:3:size(q2,2);
fc_graphics4mesh.plotelementsidx(q2,me2,'idx',idx, 'Color','b', ...
    'backgroundcolor','Salmon', 'edgecolor','b','fontsize',7)
view(3);axis image;axis off

figure(3)
fc_graphics4mesh.plotmesh(q2,me2,'FaceColor','LightGray','FaceAlpha',0.4)
hold on
fc_graphics4mesh.plotelementsidx(q1,me1,'backgroundcolor','PaleGreen1')
```

Listing 24: Using fc_graphics4mesh.**plotelementsidx** function with a 3D mesh

Informations for git maintainers of the graphics4mesh Octave package

git informations on the packages used to build this manual

```
--------------------------------------------------
   name : fc-graphics4mesh
    tag : 0.1.3
 commit : 25a6481c509a60ebf5b182f928ded0780dc4ad57
   date : 2020-03-19
   time : 05-16-31
 status : 0
--------------------------------------------------
   name : fc-tools
    tag : 0.0.31
 commit : 5f136a7a027bcb54b408a8b16be8767a0b6239de
   date : 2020-03-19
   time : 04-49-37
 status : 0
--------------------------------------------------
   name : fc-bench
    tag : 0.1.2
 commit : 666dc60d1277f5fa9c99dee4ae1c33270f22c57d
   date : 2020-02-16
   time : 06-38-46
 status : 0
--------------------------------------------------
   name : fc-amat
    tag : 0.1.2
 commit : 957340f6e71d805dbd8b9d04c434b24fd3f92591
   date : 2020-02-16
   time : 06-39-42
 status : 0
--------------------------------------------------
   name : fc-meshtools
    tag : 0.1.3
 commit : cdbc41bc98af4e4faccc1746024aced1f21aae53
   date : 2020-02-17
   time : 10-52-56
 status : 0
--------------------------------------------------
```

git informations on the LaTeX package used to build this manual

```
--------------------------------------------------
   name : fctools
    tag :
 commit : 57968c4a96c2593cccc9da9efd3e52b2ff012cb5
   date : 2020-02-07
   time : 06:41:09
 status : 1
--------------------------------------------------
```

Using the remote configuration repository:

url	`ssh://lagagit/MCS/Cuvelier/Matlab/fc-config`
commit	`ca2a4f11eb918d3020f934e3545abef8b49ef3e8`