DEMO_0010_Cylindrical_Lattice_Shell_gyroid

Table of Contents

This is a demo for:

- Building geometry for Cylindrical Lattice Shell (CLS), using gyroid structure.
- For more information: Wang, Y., Ren, X., Chen, Z., Jiang, Y., Cao, X., Fang, S., Zhao, T., Li, Y., & Fang, D. (2020). Numerical and experimental studies on compressive behavior of Gyroid lattice cylindrical shells. Materials & Design, 186, 108340. https://doi.org/10.1016/J.MATDES.2019.108340

Name

Author: *Mahtab Vafaee*, mahtab.vafaee@gmail.com


```
Change log:
2023/11/15 MV Created
2024/02/2 MV Edited
--------------------------------------------------------------------------

clear; close all; clc;
```

Plot settings

```
fontSize=20;
faceAlpha1=0.8;
markerSize=10;
lineWidth1=3;
lineWidth2=4;
markerSize1=25;
```

Control parameters

```
sampleSize=[12,1,2]; % Size of the sample
% sampleSize=[1,1,2]; % Single Cell
levelSet = 0.6; %Corelates to volume fraction

n=100; % Set the resolution
```

create a grid

```
x = linspace(-sampleSize(1)*pi,sampleSize(1)*pi,n);
y = linspace(-sampleSize(2)*pi,sampleSize(2)*pi,n);
z = linspace(-sampleSize(3)*pi,sampleSize(3)*pi,n);

[X,Y,Z] = meshgrid(x,y,z);
```

Evaluate triply periodic function

calculate the grid value to create gyroid field

```
S=(sin(X).*cos(Y))+(sin(Y).*cos(Z))+(cos(X).*sin(Z));

% creating a surface
[Fi,Vi]=isosurface(X,Y,Z,S,levelSet);
[Fc,Vc]=isocaps(X,Y,Z,S,levelSet);

[F,V]=joinElementSets({Fi,Fc},{Vi,Vc});
[F,V]=mergeVertices(F,V);

r=12; % a radius to conserve circumferential area
c= max(y)-min(y);

rho = Y + r; % converting the y coordinates to radius
theta = (X./c)*(2*pi/12); % calculate the rotation/curvature of the grids
```

mapping from polar to new cartesian coordinates

```
% compute Cartesian coordinates for grid points
X1 = rho .* cos(theta);
Y1 = rho .* sin(theta);
Z1 = Z;

% creating a surface
[Fi,Vi]=isosurface(X1,Y1,Z1,S,levelSet);
[Fc,Vc]=isocaps(X1,Y1,Z1,S,levelSet);

[F1,V1]=joinElementSets({Fi,Fc},{Vi,Vc});
[F1,V1]=mergeVertices(F1,V1);
```

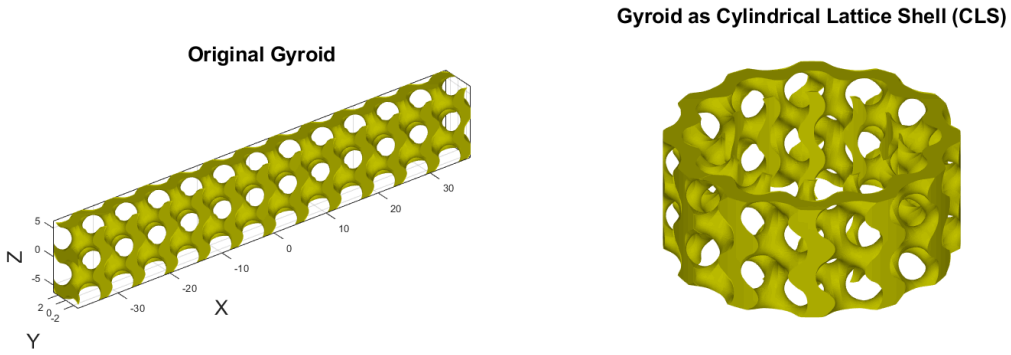
Visualize original and deformed surfaces

```
cFigure; hold on;

subplot(1,2,1); hold on;
title('Original Gyroid','FontSize',fontSize);
gpatch(F,V,[0.75, 0.75, 0],'none',1);
gca.Xcolor= 'red'; axis on;
```

```
axisGeom(gca,fontSize);
camlight headlight;
drawnow;

hs=subplot(1,2,2); hold on;
title('Gyroid as Cylindrical Lattice Shell (CLS)','FontSize',fontSize);
gpatch(F1,V1,[0.75, 0.75, 0],'none',1);
axisGeom(gca,fontSize);
axis off; box on;
camlight headlight;
drawnow;
```



Published with MATLAB® R2021b