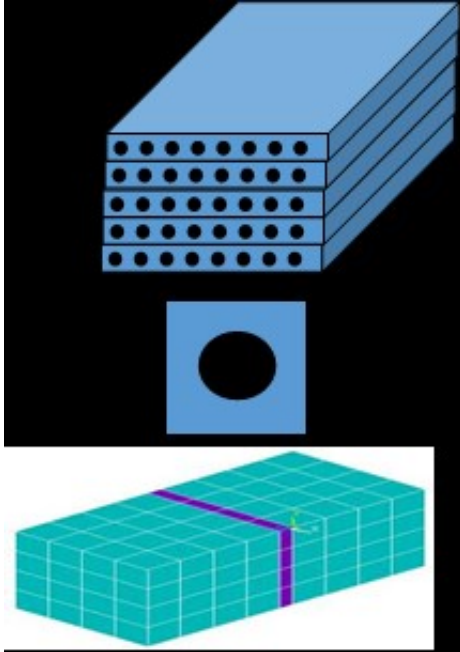


Predictions of 3D effective properties of fiber reinforced composites

The SG of fiber reinforced composites can be represented as shown below.



Let the material properties of the fiber and matrix be: Fiber: $E_{11} = 230 \text{ GPa}$, $E_{22} = 15 \text{ GPa}$, $G_{12} = G_{13} = 15 \text{ GPa}$, $G_{23} = 7 \text{ GPa}$, $\nu_{12} = \nu_{13} = 0.2000$ $\nu_{23} = 0.0714$.

Matrix: $E = 4.0 \text{ GPa}$, $\nu = 0.35$

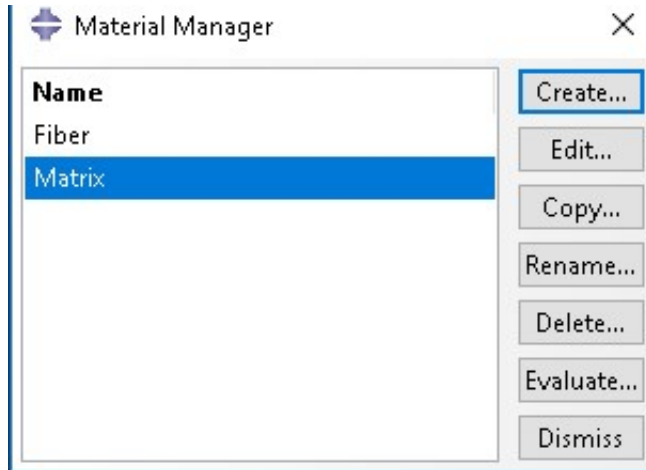
Fiber volume of fraction is assumed to be 60% The material properties are obtained from:
 "Soden, P. D., Hinton M. J. and Kaddour, A. S., Lamina properties, lay-up configurations and loading conditions for a range of fibre reinforced composite laminates. Compos. Sci. Technol., 1998, 58(7), 1011"

youtube link.

<https://youtu.be/Bf-uKbd57uw>

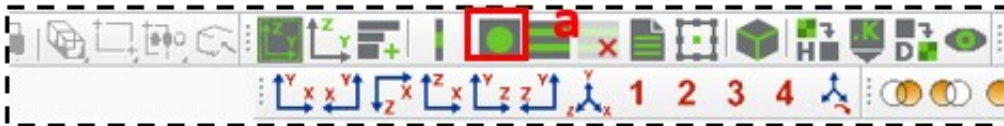
Step 1: Input material properties

There are two materials namely fiber and matrix



Step 2: Select appropriate SG

a. Select 2D SG that represent the current example



b. 2D SG wizard shows up

c. Select Square pack as microstructure

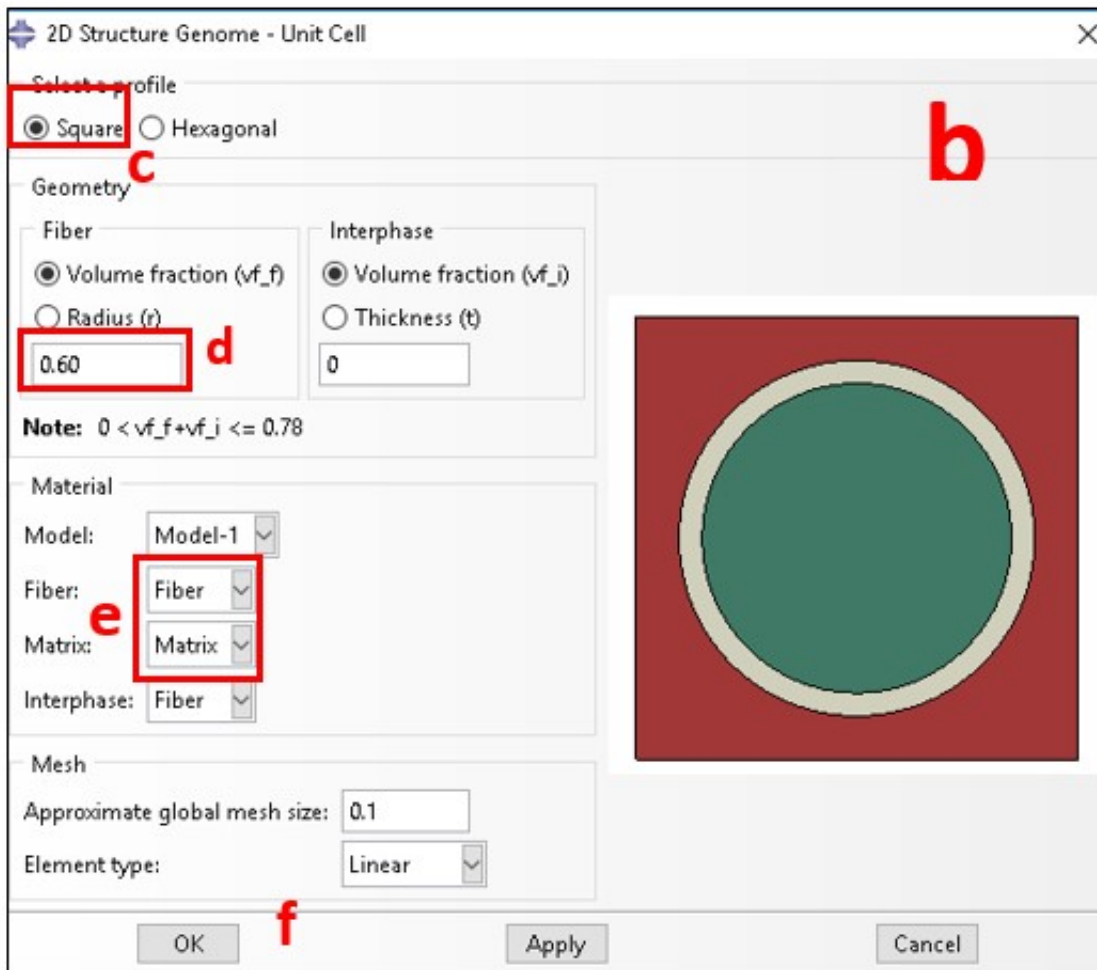
d. Add fiber volume fraction

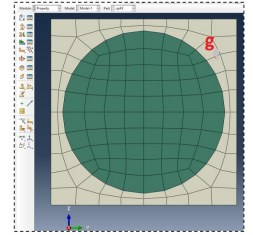
e. Select material properties for fiber and matrix

f. Click on OK to generate the SG

g. See generated 2D SG

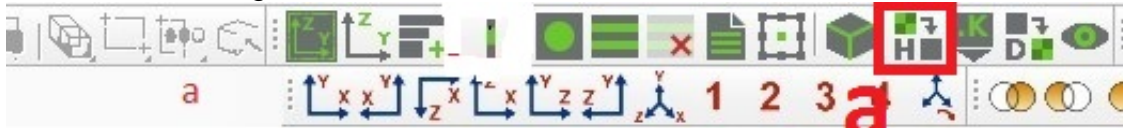
PREDICTIONS OF 3D EFFECTIVE PROPERTIES OF FIBER REINFORCED COMPOSITES





Step 3- Homogenization- 3D effective properties

a. Click on Homogenization



b. Homogenization wizard shows up (see below)

c. Select 3D (solid) Model

d. Select analysis type, elastic

e. Click on OK to start homogenization

f. See the predicted 3D effective properties

PREDICTIONS OF 3D EFFECTIVE PROPERTIES OF FIBER REINFORCED COMPOSITES

Homogenization

New SwiftComp file name:

Model source

CAE Input file

Model: Part:

Macroscopic model

Dimension

1D (Beam)

2D (Shell)

3D (Solid)

Dimensionally reducible structures

Specific model:

Omega:

Note: Provide omega if the part is not a line, rectangle or cube

Options

Analysis type:

Element type:

Elemental orientation:

Temperature distribution:

Aperiodic

y1 y2 y3

Only generate input file. Do not run SwiftComp.

OK

e

Cancel

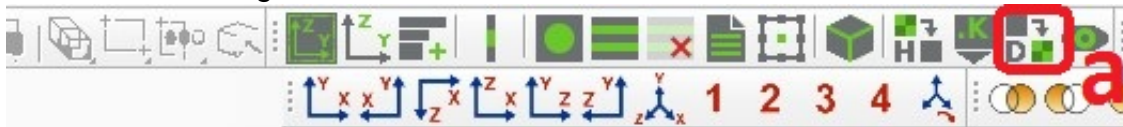
b

c

d

Step 4: Perform dehomogenization

a. Select dehomogenization



b. Dehomogenization wizard shows up

c. Select opt file

d. Add displacement to recovery displacement or strain loading to recover both local strain and stress, for current example problem let e_{11} be 0.005 and $2e_{23}$ be 0.002 e. Click on OK to start dehomogenization

f. See, dehomogenization

PREDICTIONS OF 3D EFFECTIVE PROPERTIES OF FIBER REINFORCED COMPOSITES

Dehomogenization ×

SG model source

CAE SwiftComp Input file

sqrP2 nSG2 3D S4pbc

c **b**

Macroscopic analysis results

Displacements **d**

	v1	v2	v3
	0.0	0.0	0.0

Rotations

	1.0	0.0	0.0
	0.0	1.0	0.0
	0.0	0.0	1.0

Generalized strains **d**

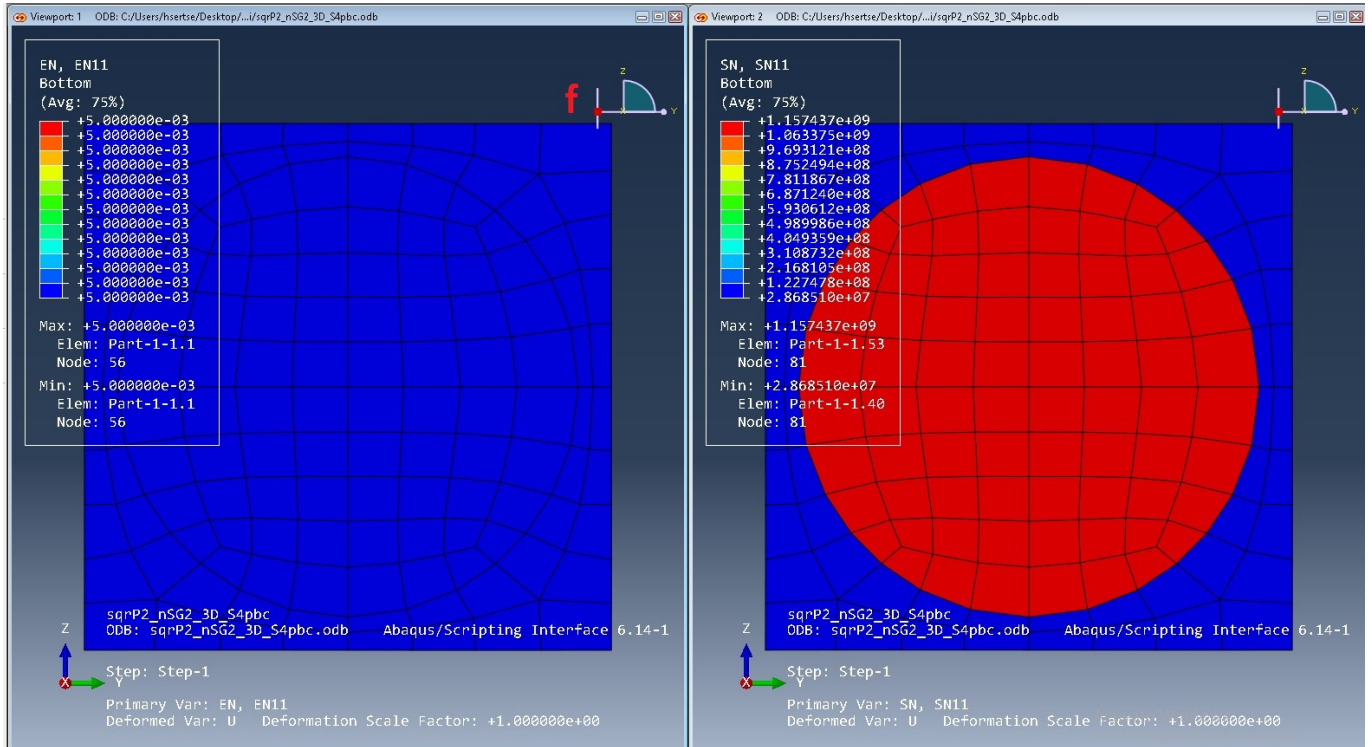
epsilon11	epsilon22	epsilon33
0.005	0.0	0.0
2epsilon23	2epsilon13	2epsilon12
0.002	0.0	0.0

Additional inputs

temperature increment

e

PREDICTIONS OF 3D EFFECTIVE PROPERTIES OF FIBER REINFORCED COMPOSITES



youtube link.

<https://youtu.be/Bf-uKbd57uw>