# 2D example linear elasticity cooks membrane

import numpy as np

import matplotlib.pyplot as plt

import PyFEMP

import PyFEMP.elements.Elmt\_BaMo\_2D as ELEMENT

FEM = PyFEMP.FEM\_Simulation(ELEMENT)

n, sig = 2, 100

XI, Elem = PyFEMP.msh\_conv\_quad([0.0, 0.0], [48.0, 44.0], [48.0, 60.0], [0.0, 44.0], [2\*n, n], type='Q1')

FEM.Add\_Mesh(XI, Elem)

FEM.Add\_Material([2100, 0.3], "All")

FEM.Add\_EBC("x==0", "UX", 0)

FEM.Add\_EBC("x==0", "UY", 0)

FEM.Add\_NBC("x==48", "UY", (sig\*16)/n)

FEM.Add\_NBC("x==48 and (y==60 or y==44)" , "UY", 1/2 \* (sig\*16)/n)

FEM.Analysis()

FEM.NextStep(1.0, 1.0)

print( FEM.NewtonIteration() )

print( FEM.NewtonIteration() )

ux = FEM.NodalDof("x==48 and y==60","UX")

uy = FEM.NodalDof("x==48 and y==60","UY")

print('ux :',ux, 'uy :',uy)

fig, axs = plt.subplots(1, 2, figsize=(12.0, 8.0))

postplot = FEM.ShowMesh(axs[0], boundaryconditions=True)

axs[0].legend()

postplot = FEM.ShowMesh(axs[1], deformedmesh=True, PostName="SigMises")

cbar = fig.colorbar(postplot)

cbar.ax.set\_ylabel('von Mises stress $\sigma\_{VM}$')

plt.show()