Homeworks on the computer codes from the book Drosopoulos and Stavroulakis

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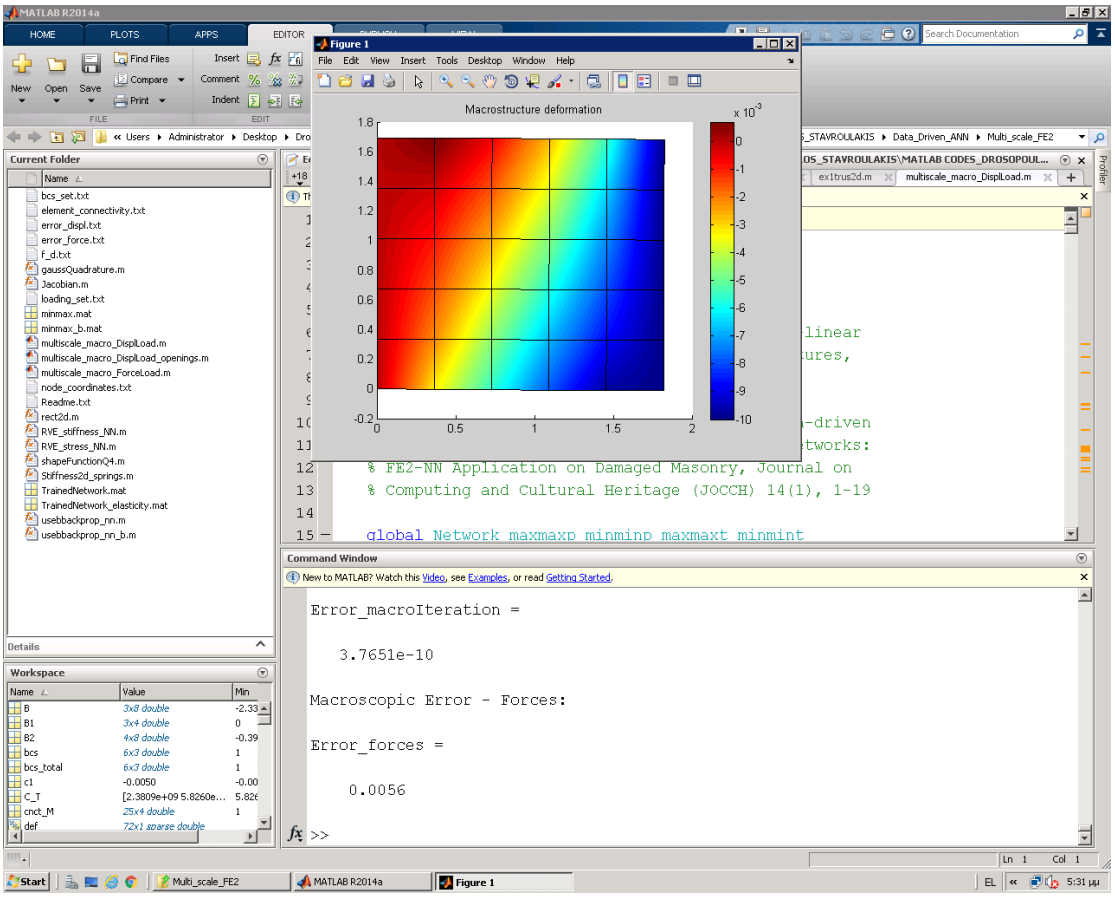

a) Effect of finite element mesh on the results
Use the code Directory MultiScaleFE2, file: multiscale_factor_DispLoad.m

Use a different mesh by modifying the one already existing

```
% 1. Mesh
% Length and number of segments in x direction
lx_M = 1.82; ix_M = 5;
% Length and number of segments in y direction
ly_M = 1.69; iy_M = 5;
```

For example instead of 5x5 segments (i.e. 6 nodes x 6 nodes in the two-dimensional plate) use a different one.

b) Effect of different neural network or other metamodel
Use the codes in Directory Neural Networks
b.1) Train the neural network with less data from the given database and try to compare predictions of the neural network with the usage of the full set and the reduced number of data.

b.2) Use a different neural network metamodel
Do not forget to copy the trained neural network in the directory MultiScaleFE2 in order to proceed with multiscale calculations !!!

c) For more experienced users. Replace the tangential elasticity estimate using neural networks with a Physics Informed estimate based on the strain-stress relation.
The provided code uses two data sets and two neural networks in order to estimate separately the strain-stress constitutive law and the strain-tangential stiffness contributions.
Neverthelss the tangential stiffness can be produced from the first neural network by differentiation with respect to its arguments (elements of strain tensor). You may need to write a code for differentiation of the neural network or use neural network implementation that provide this option (PINNs) from Matlab deep learning code or Python Tensorflow package !!!

"nn_training_testing.m" == Code for training and testing a "strain-stress" neural network. A strain-stress data-set is imported and used to train the neural network.

The function "bbackprop.m" is used in this code to perform the training of the neural network.

The function "usebbackprop.m" is also used in this code to perform the testing, thus, the comparison between desired output values, derived from the data-set and corresponding predicted values, derived using the trained neural network.

2) "nn_training_testing_b.m" == Code for training and testing a "strain-elasticity" neural network. A strain-elasticity data-set is imported and used to train the neural network.

The function "bbackprop.m" is used in this code to perform the training of the neural network.

The function "usebbackprop_b.m" is also used in this code to perform the testing, thus, the comparison between desired output values, derived from the data-set and corresponding predicted values, derived using the trained neural network.