Summary of fdd_k.m matlab function for FDD in OMA

1. Open run_fdd_k.m
   This uses an ARTeMIS data set called 'plate with harmonics'.

   fdd_k.m consist of the following steps:

   a) Define measurement parameters
   b) Power spectral density matrix
      A new function called cpsd_k.m was written to build the power spectral density matrix. This uses convolution in the frequency domain and hermetian symmetry to improve the efficiency compared to the stand Matlab function cpsd.m. In the current example the cpsd.m takes 18s while the cpsd_k.m takes 7s. This will significantly improve batch processing times and the implementation (i.e. source code) will be published in the appendix of the first journal article on modal parameter migration and multivariate statistics. Also note that cpsd_k.m uses a hanning window with 50% overlap.
   c) Singular value decomposition
      Here the user is asked to choose the number of plotted singular values. This is key in understanding the decoupled dynamics of the system and identifying spurious, noise and closely spaced modes.
   d) Modal parameter identification – peak picking
      Here the user chooses the number of modes he/she wishes to consider. A rectangle is then drawn around the desired peaks and space bar is pressed to accept the choice. A simple peak picking finds the maximum in each rectangle, and sorts and saves the natural frequencies.
   e) The mode shapes associated with each natural frequency are then extracted from the singular vectors. This is saved and displayed.
   f) Complexity plots for each selected mode are displayed.
   g) The MAC matrix is then calculated and displayed.

The following figures show the results of fdd_k.m on the plate with harmonics data. This is followed by a comparison of the modal parameters estimated in ARTeMIS. It can be seen that the natural frequencies and mode shapes agree, with an unknown scaling difference in the mode shapes which is expected since OMA has unscaled eigenvectors.

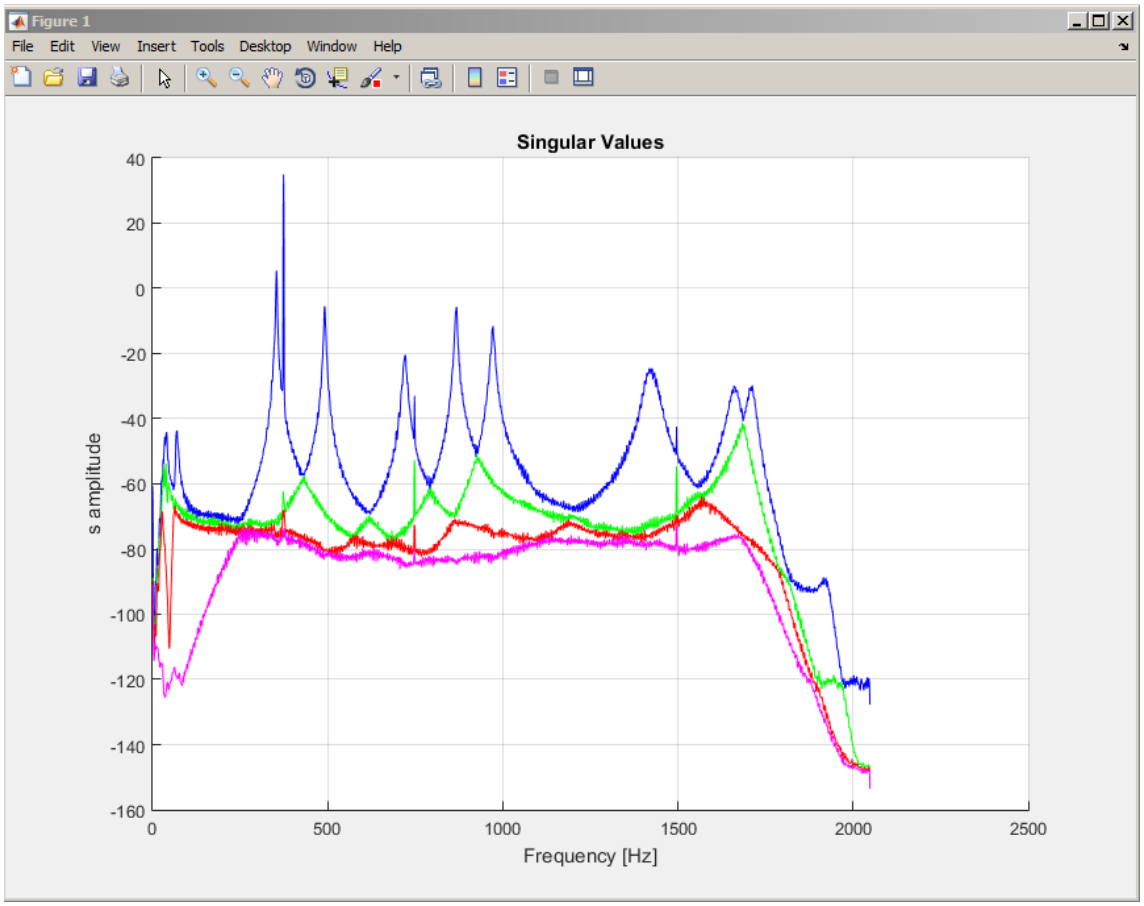
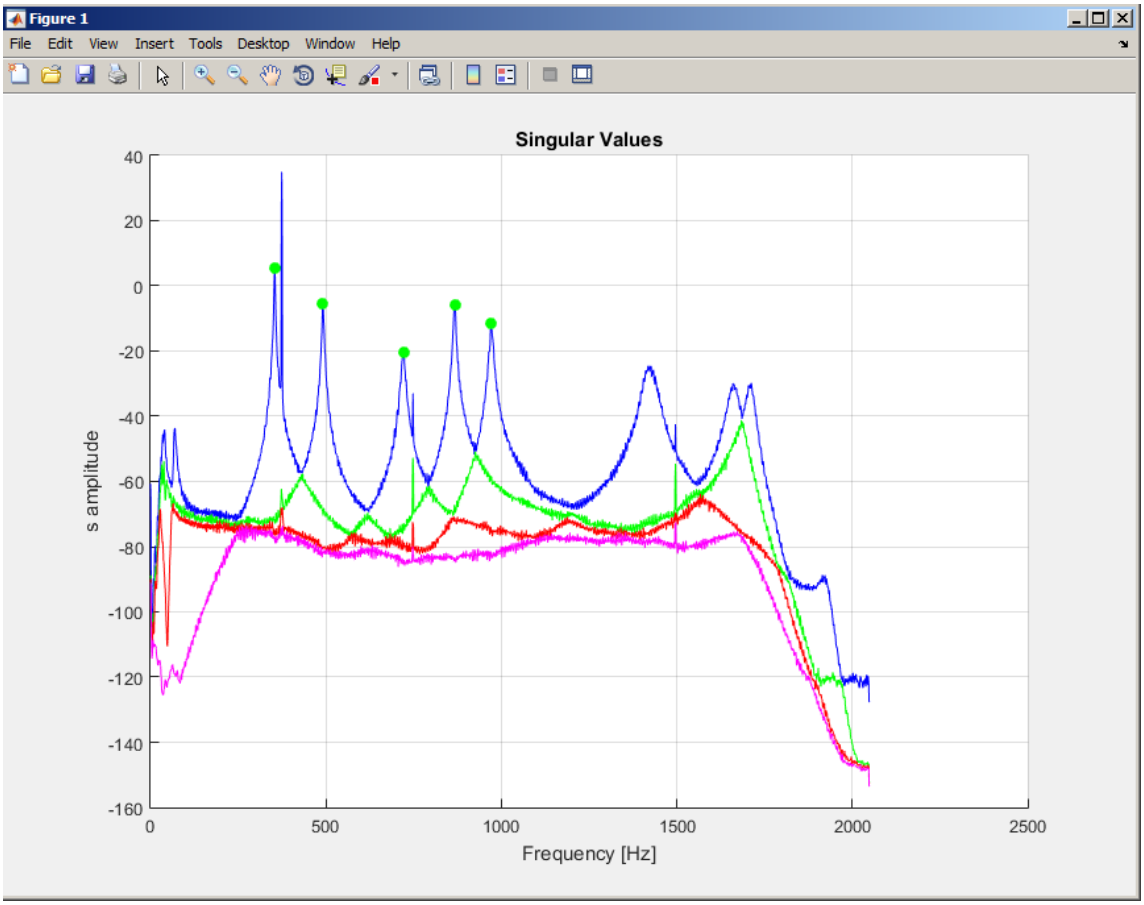


Figure 1
File Edit View Insert Tools Desktop Window Help
Singular Values
s amplitude
Frequency [Hz]
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
0
500
1000
1500
2000
2500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s amplitude
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40
20
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-140
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0
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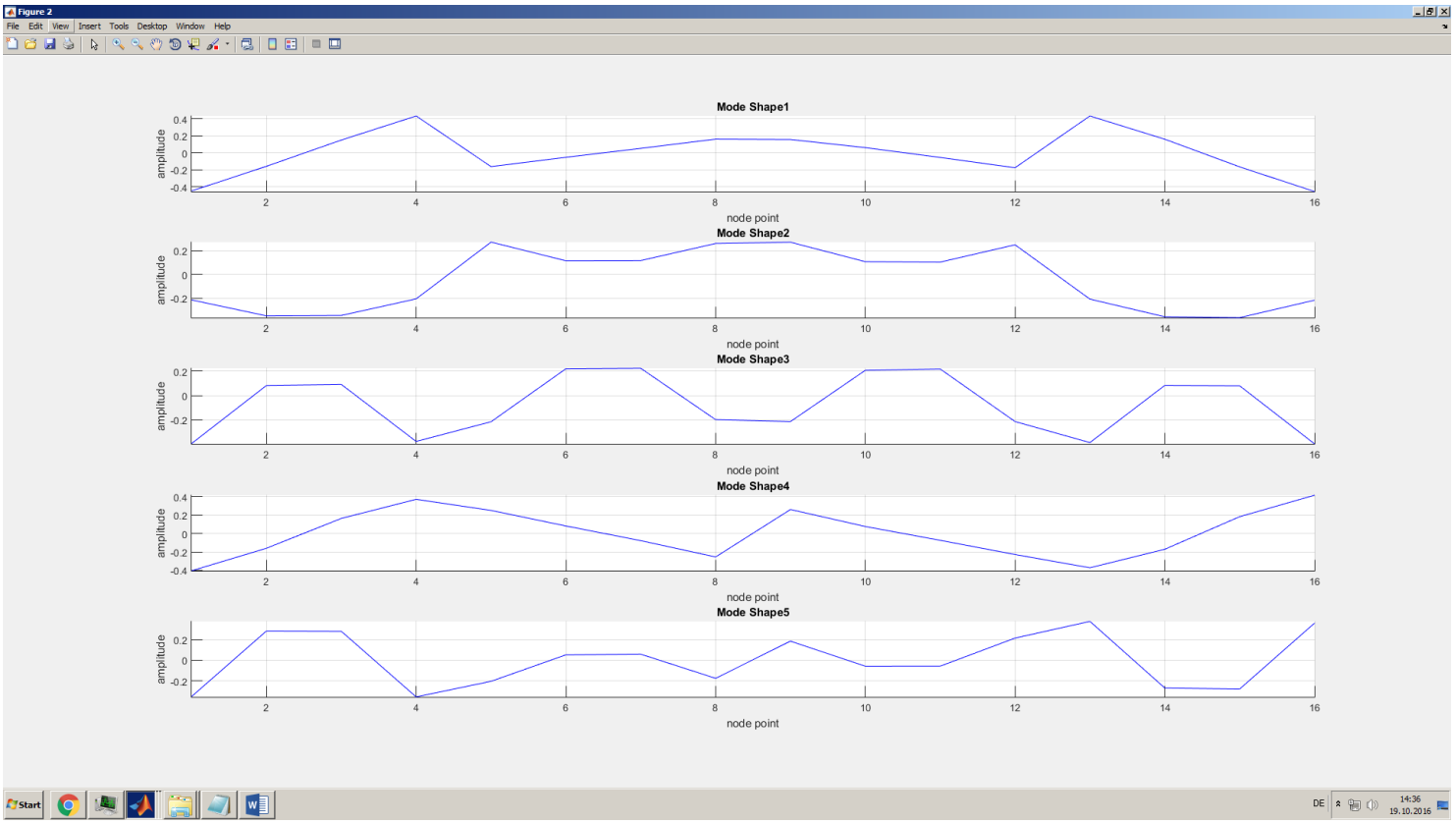


Figure 2
File Edit View Insert Tools Desktop Window Help
Mode Shape1
amplitude
node point
Mode Shape2
amplitude
node point
Mode Shape3
amplitude
node point
Mode Shape4
amplitude
node point
Mode Shape5
amplitude
node point
Start
DE
14:36
19.10.2016

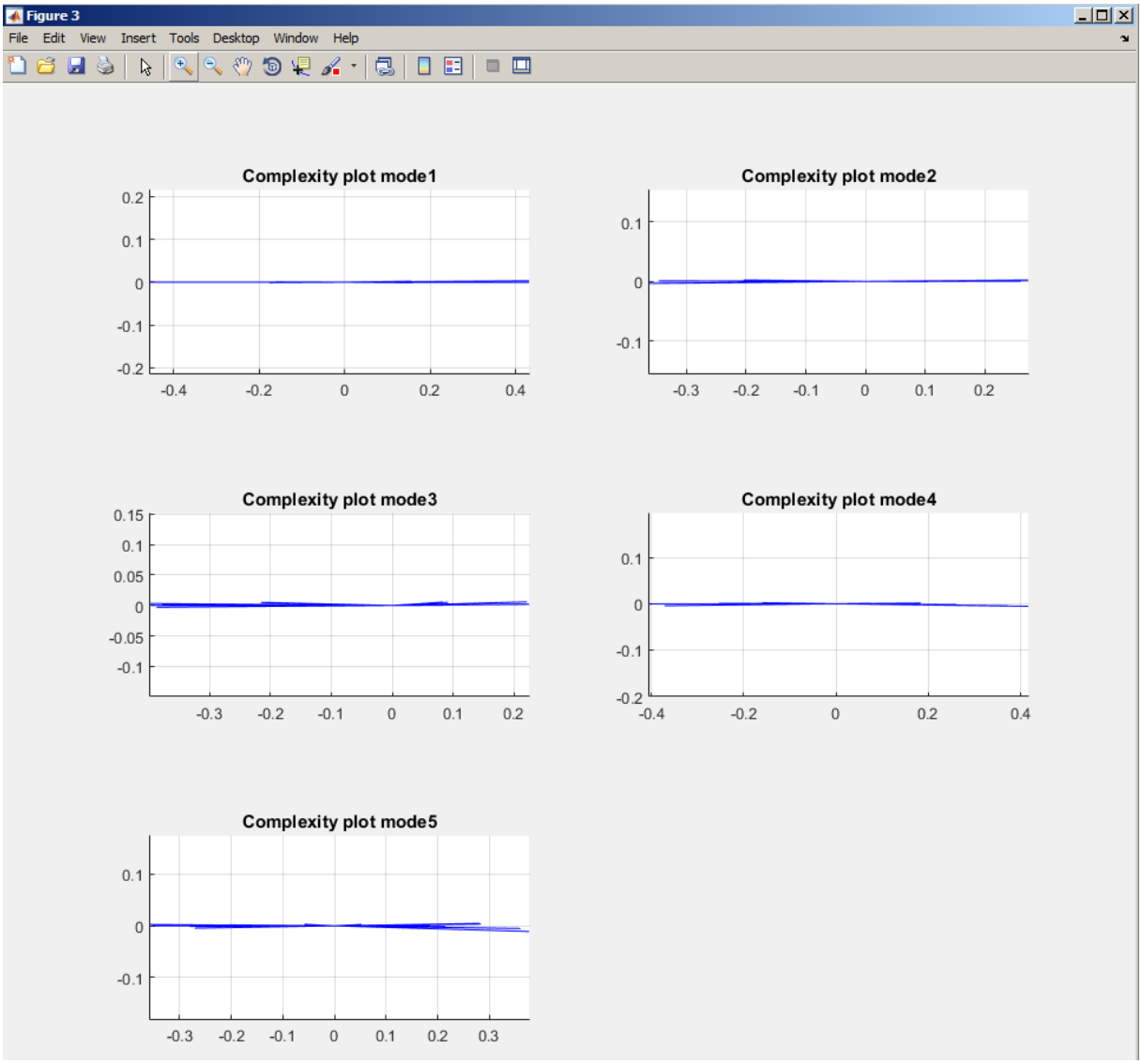
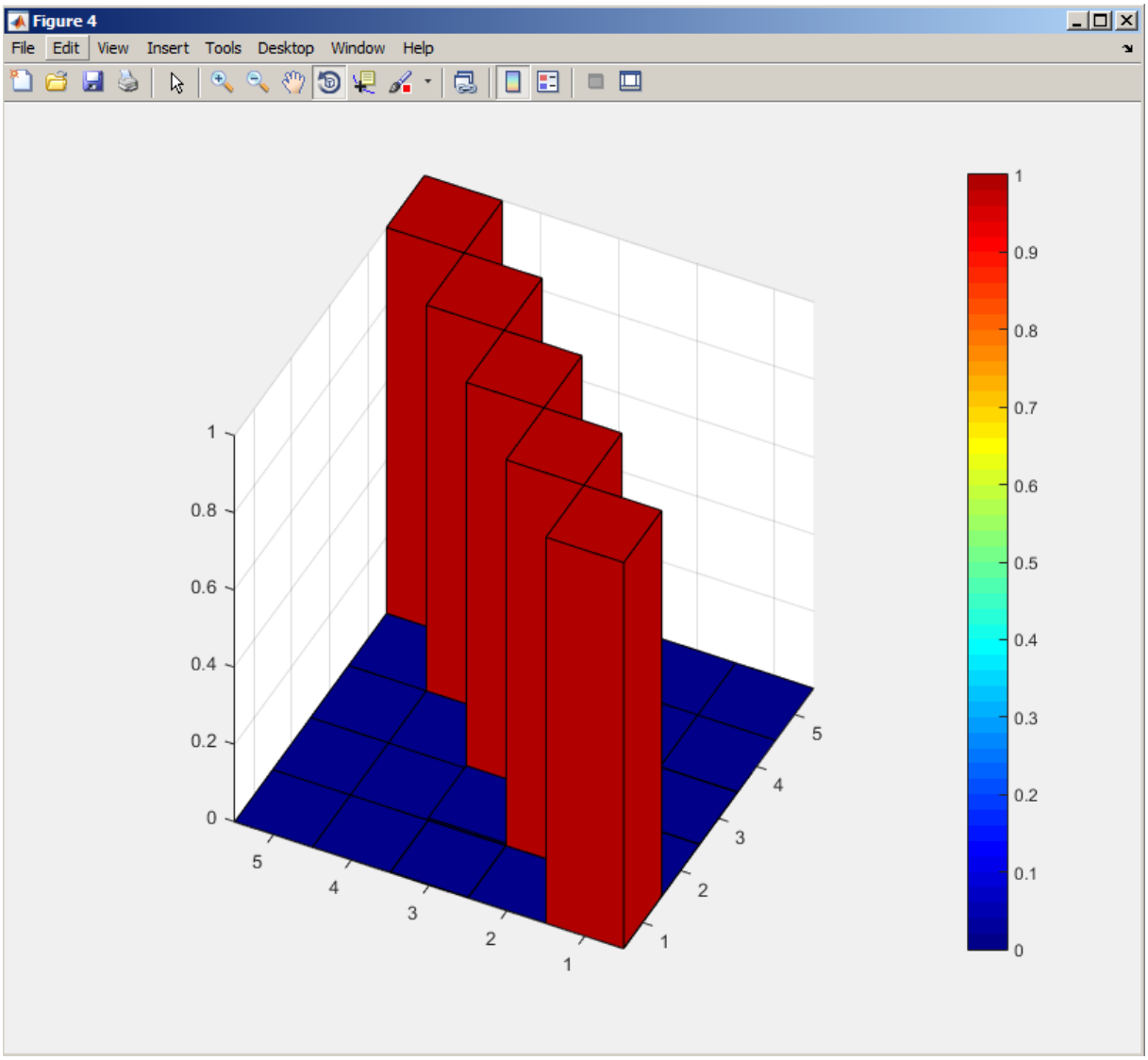


Figure 3
File Edit View Insert Tools Desktop Window Help
Complexity plot mode1
Complexity plot mode2
Complexity plot mode3
Complexity plot mode4
Complexity plot mode5



Fdd_k.m vs ARTeMIS

```
Matlab

Frq =

  353.7500
  491.2500
  722.2500

ARTeMIS

natFreq =

  353.7505
  491.2492
  722.2499
```

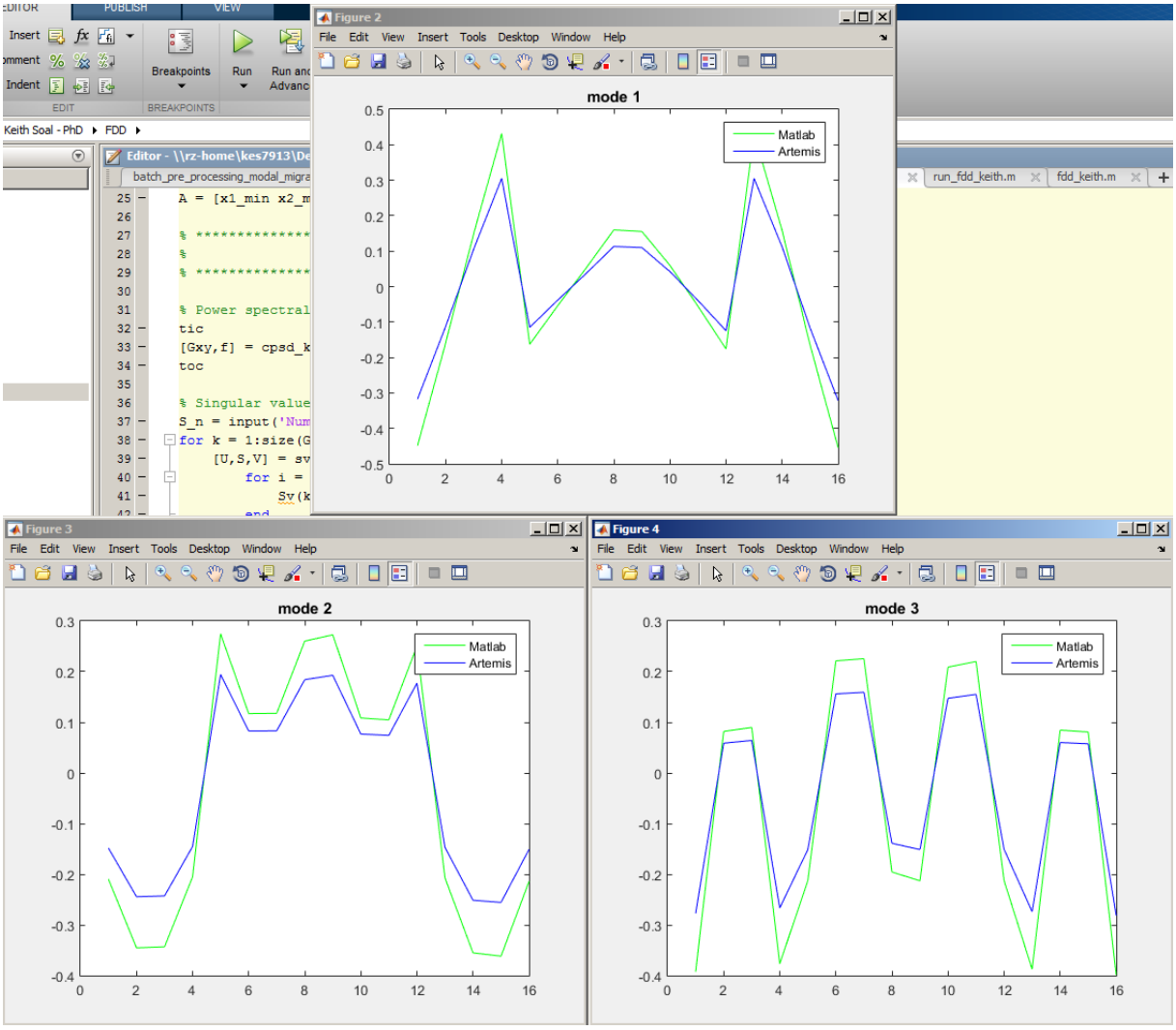


Figure 2
File Edit View Insert Tools Desktop Window Help
mode 1
Matlab
Artemis
Figure 3
File Edit View Insert Tools Desktop Window Help
mode 2
Matlab
Artemis
Figure 4
File Edit View Insert Tools Desktop Window Help
mode 3
Matlab
Artemis