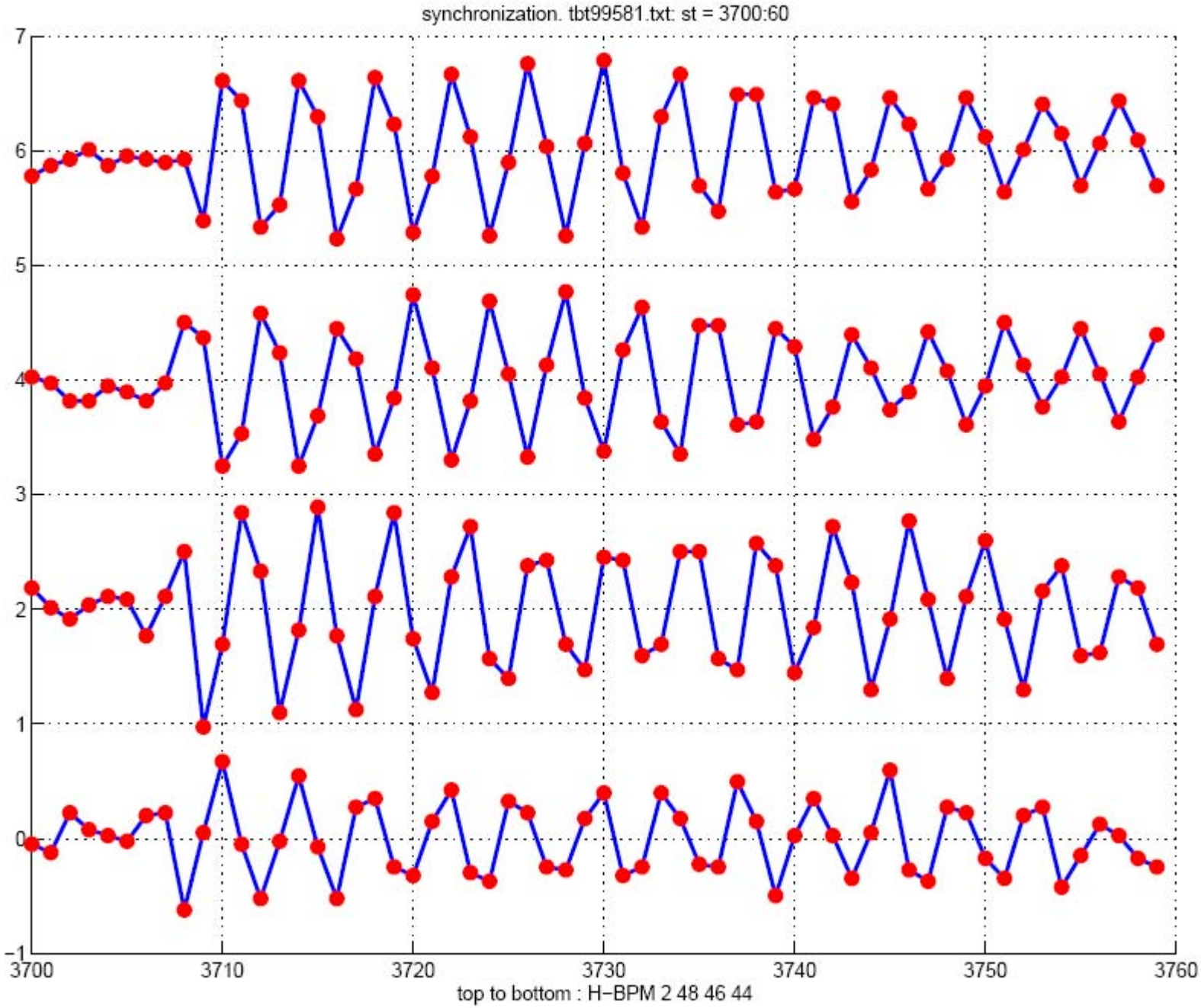

synchronization. tbt99581.txt: st = 3700:60
7
6
5
4
3
2
1
0
−1
3700
3710
3720
3730
3740
3750
3760
top to bottom : H−BPM 2 48 46 44
Student Version of MATLAB

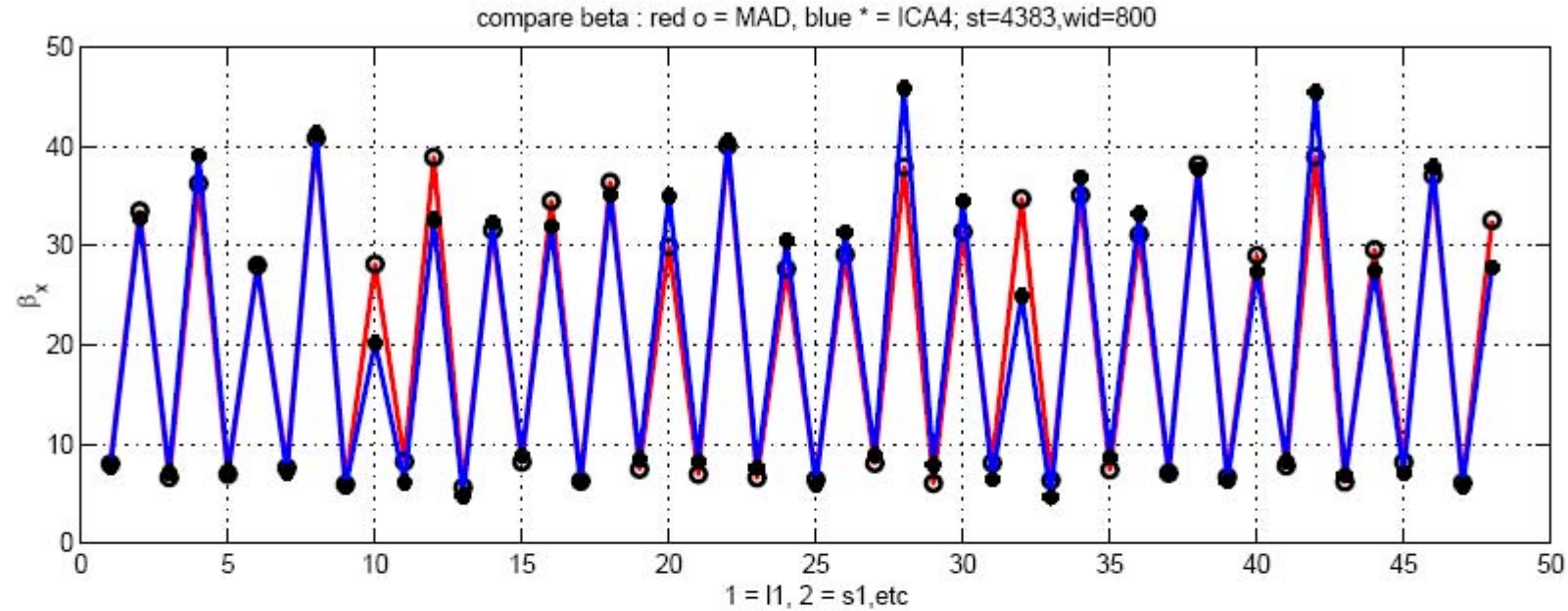
Independent Component Analysis

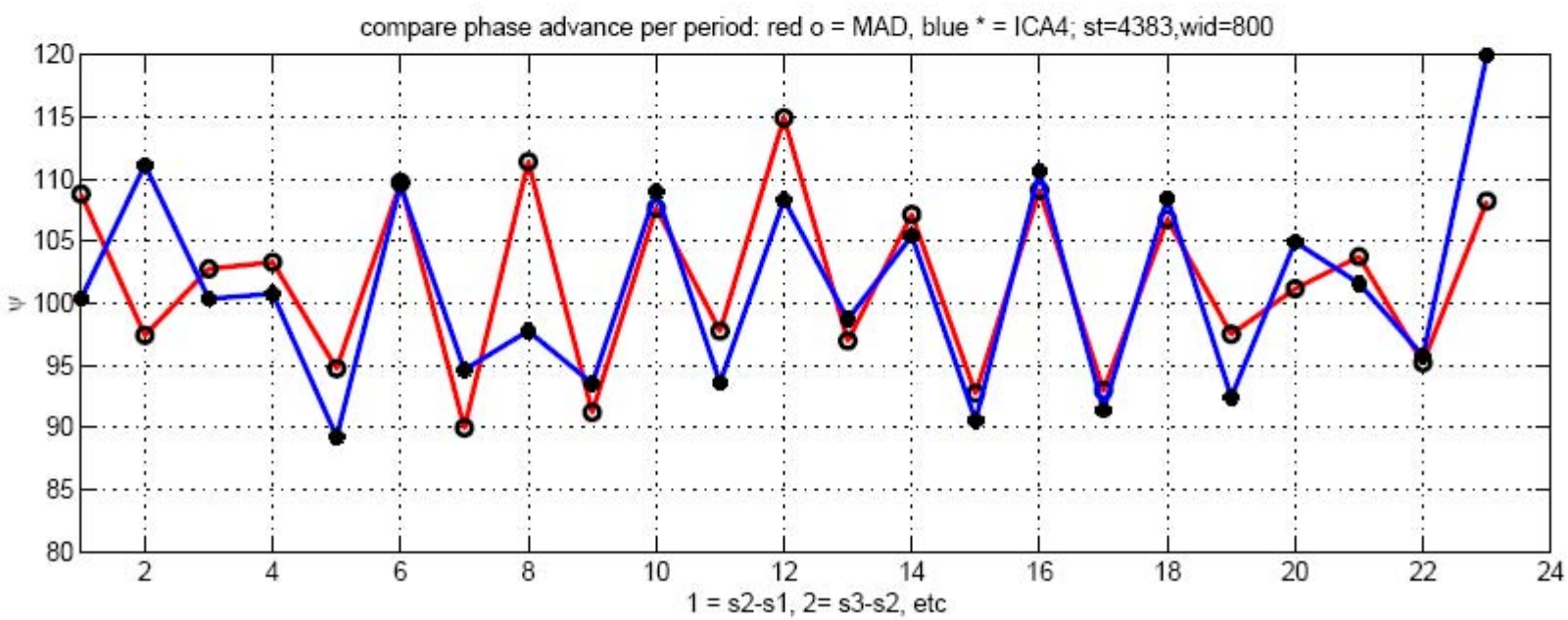
- Compute autocorrelation matrix with time lag τ

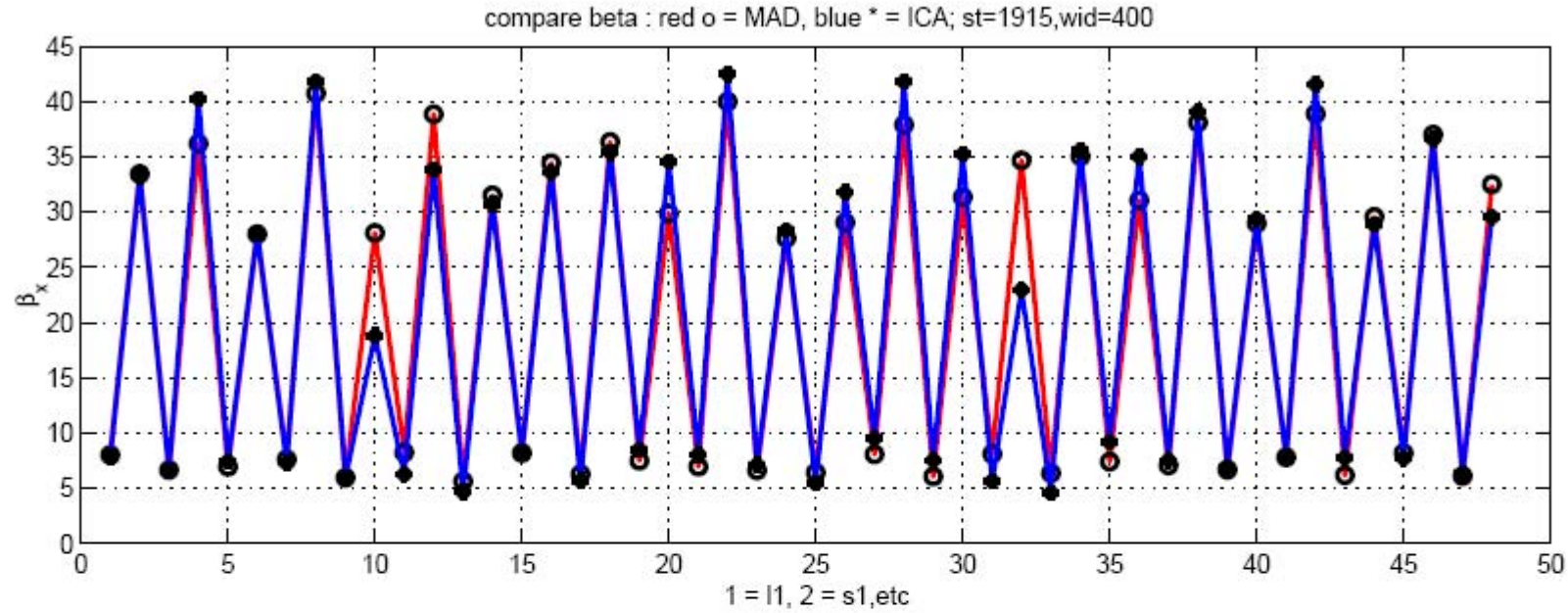
  $Cx = E\{x(t)x(t-\tau)^T\}$
- Joint diagonalization of autocorrelation matrices
- Use transform matrix to get source signals

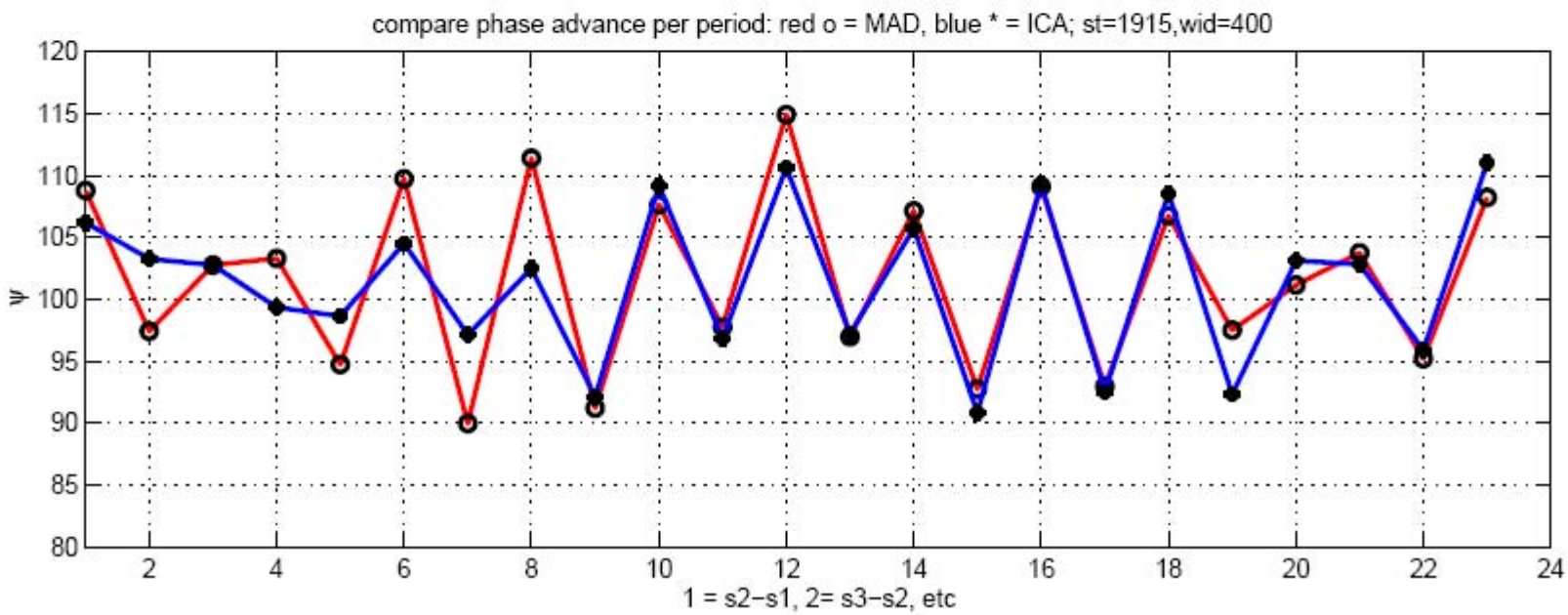
The benefits from ICA

- 1. Decoupling → better optics measurement
- 2. Higher modes can be tracked to their origins.
- 3. Synchrotron motion signals can be studied
- 4. More plausible noise reduction.


compare beta : red o = MAD, blue * = ICA4; st=4383,wid=800
β_x
1 = I1, 2 = s1,etc


compare phase advance per period: red o = MAD, blue * = ICA4; st=4383,wid=800
ψ
1 = s2-s1, 2= s3-s2, etc





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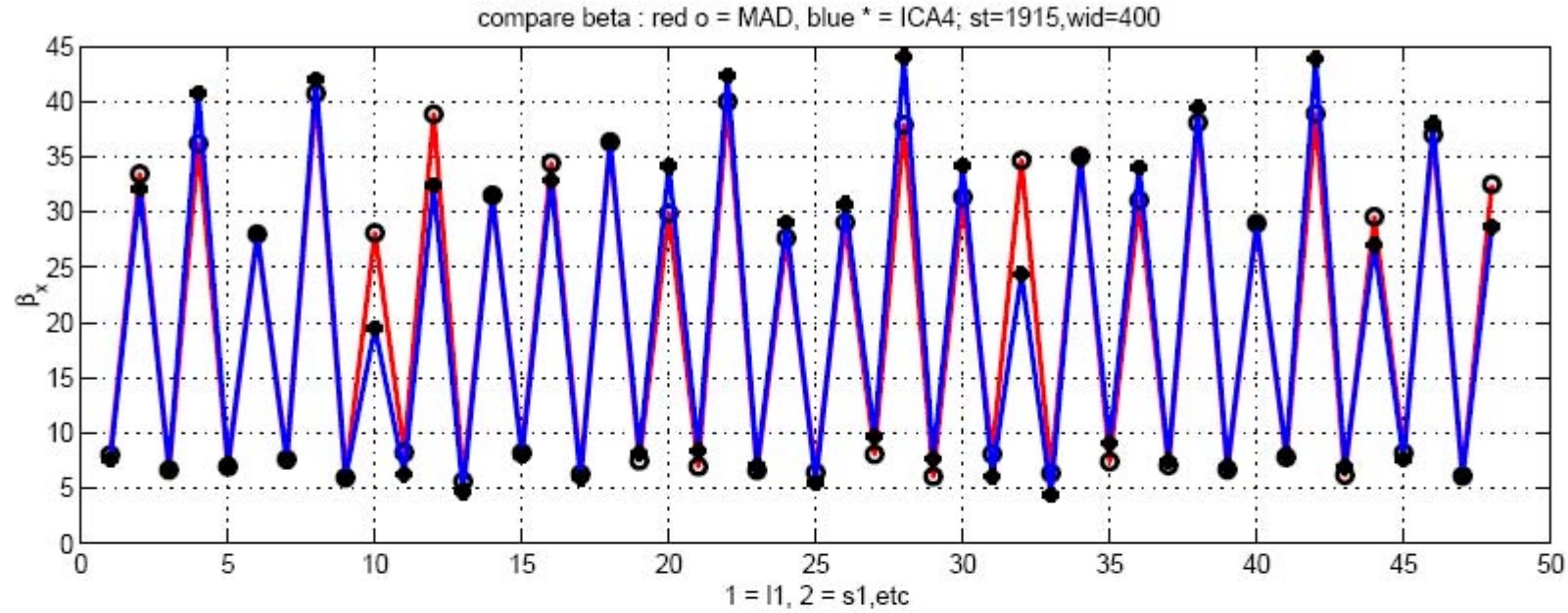

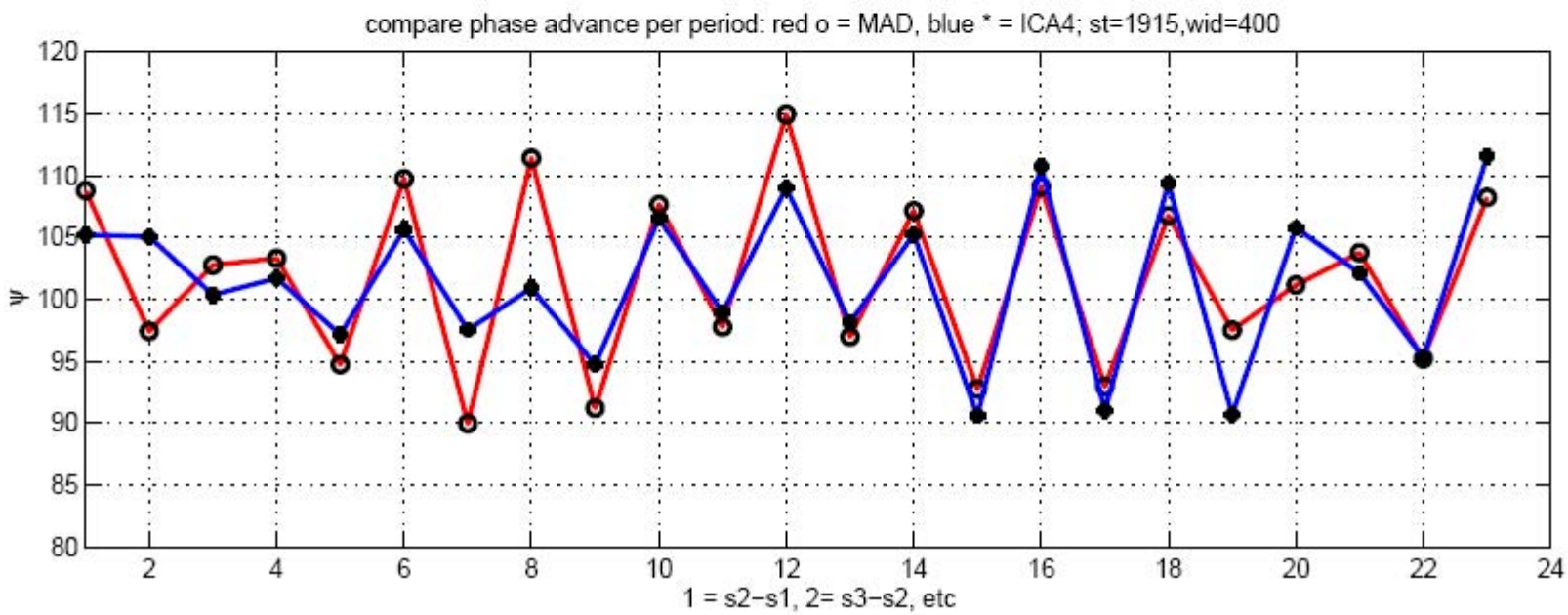

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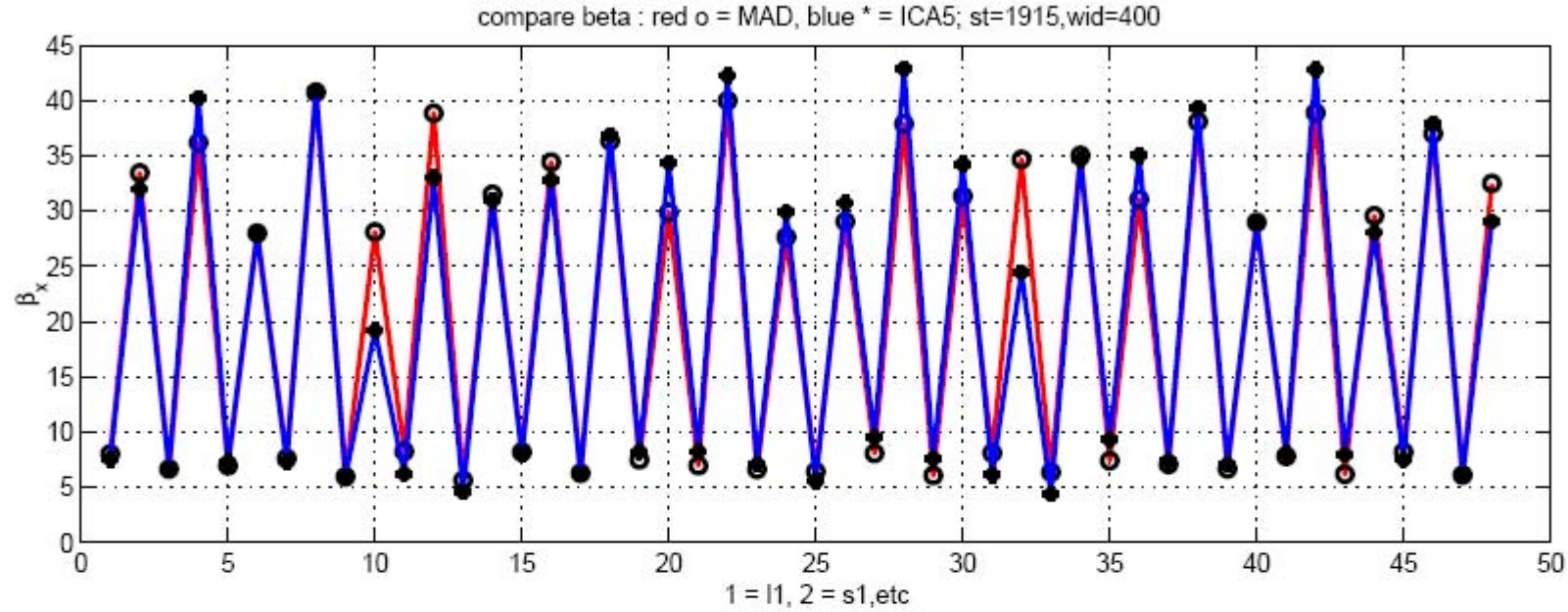
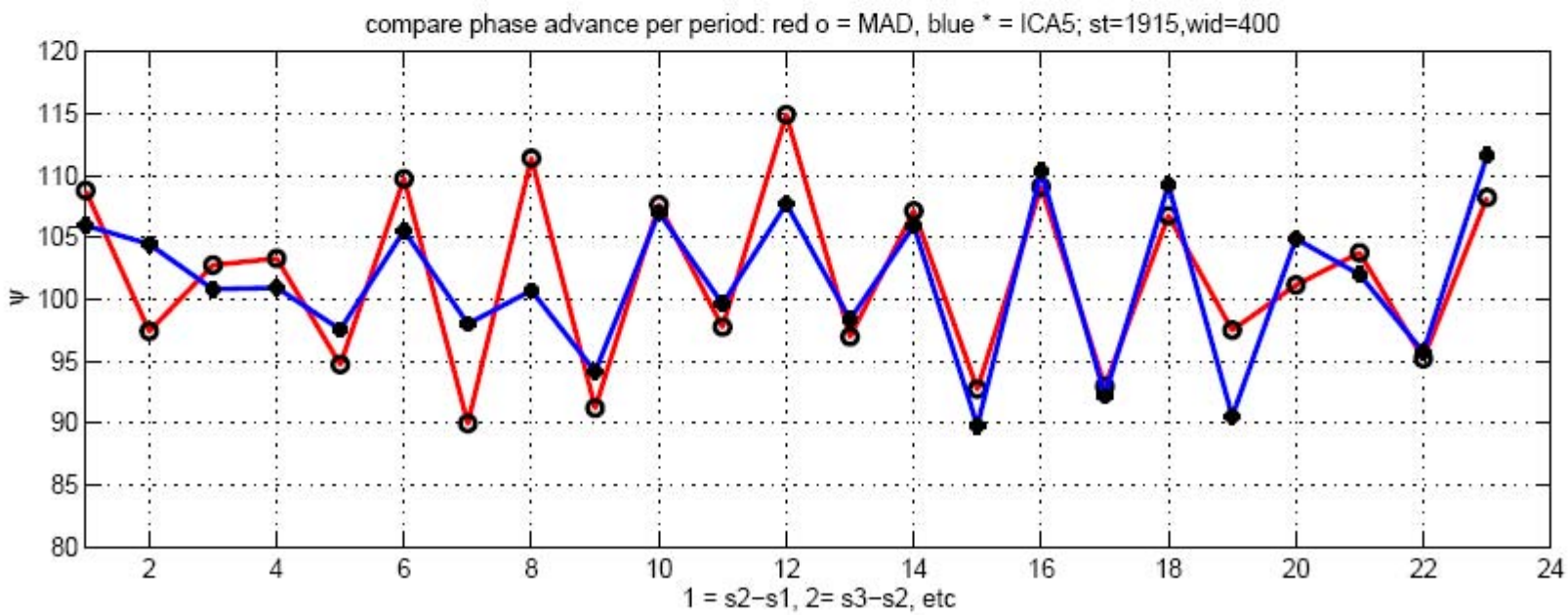
orizontal: 1915:400





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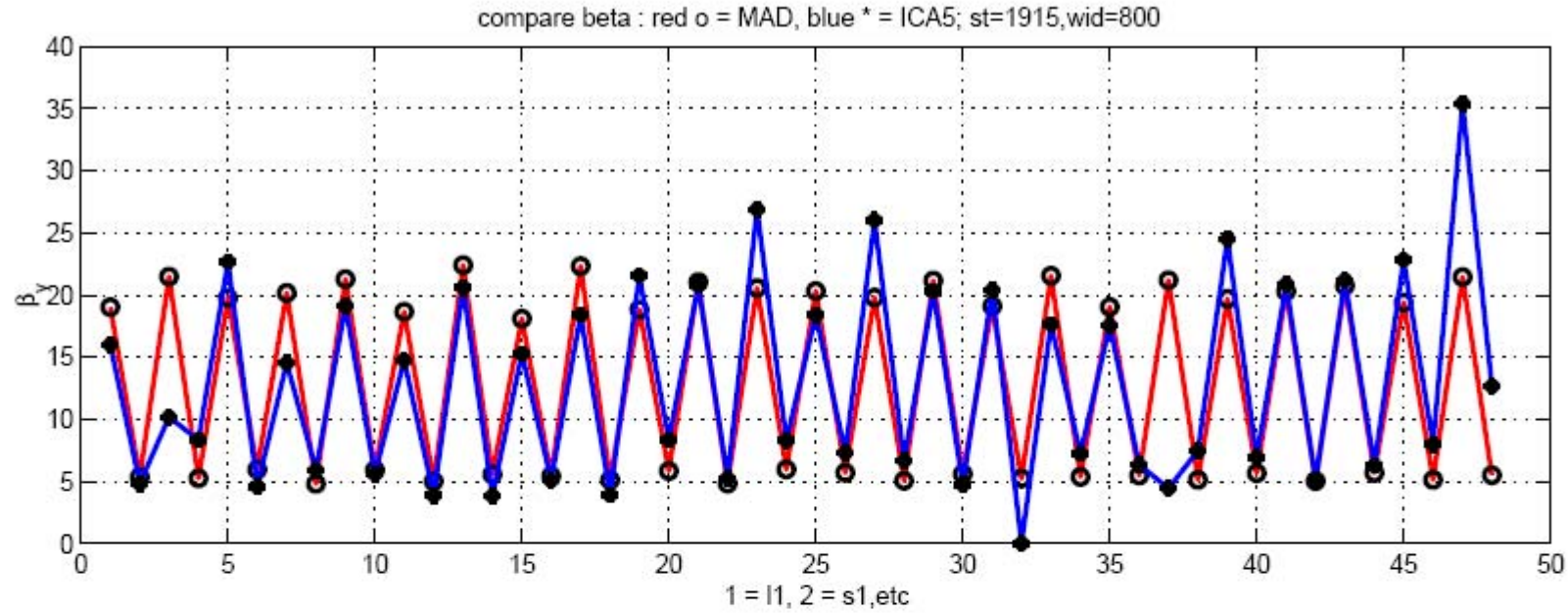
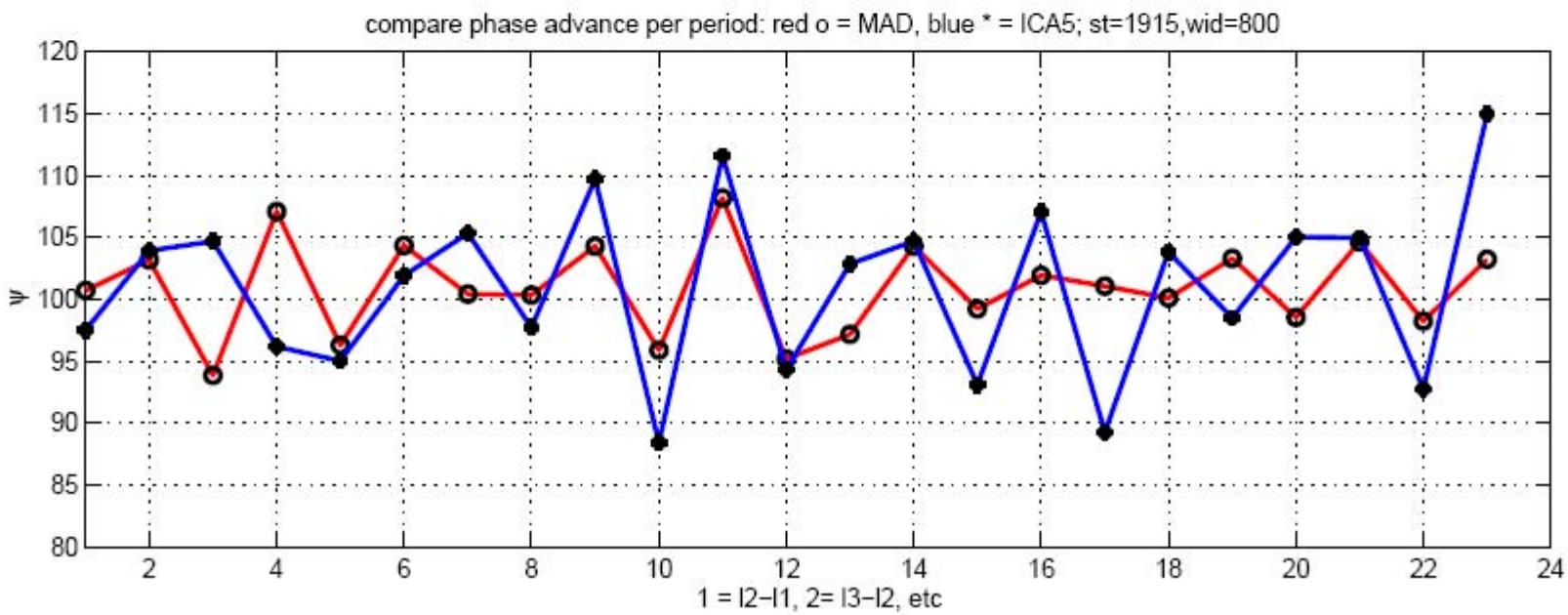
ertical: 1915:800





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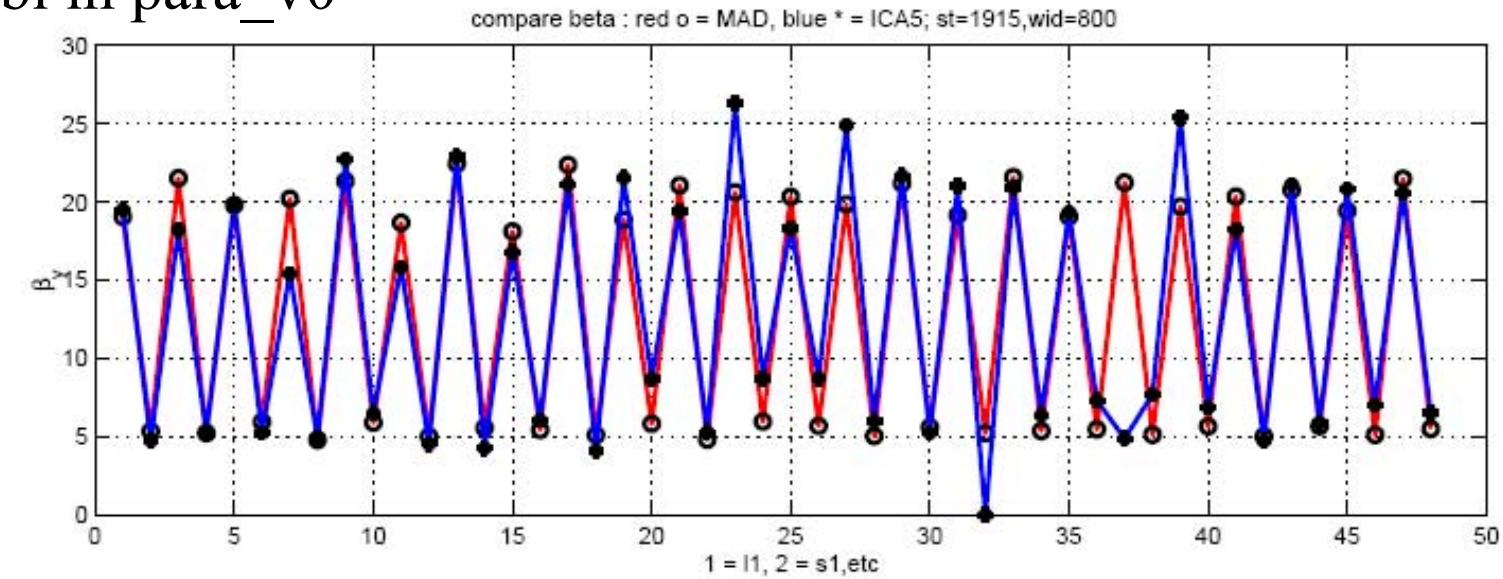
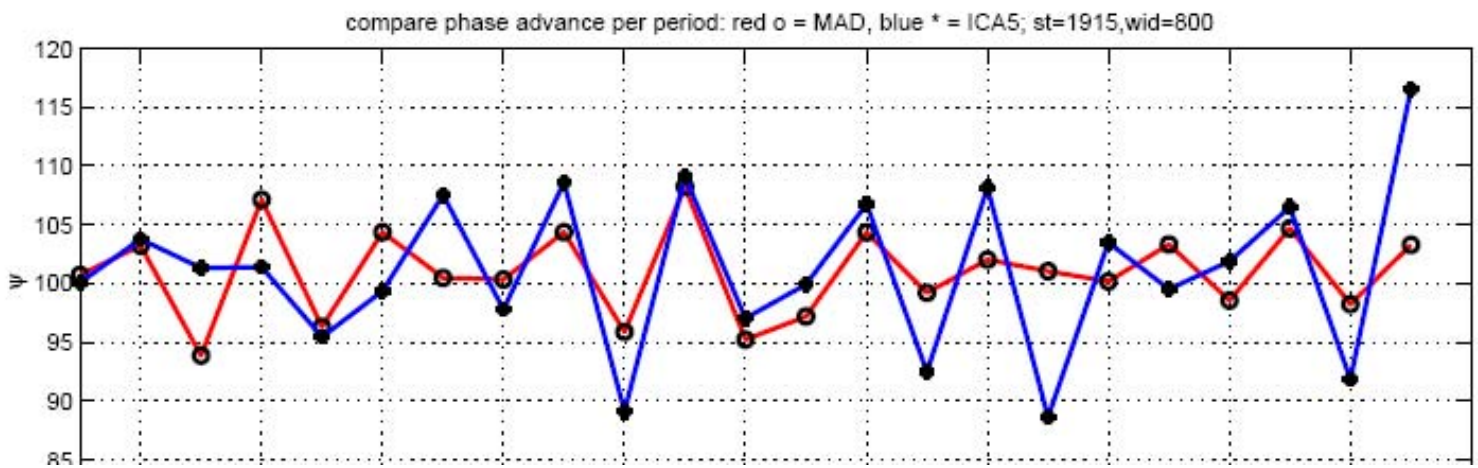
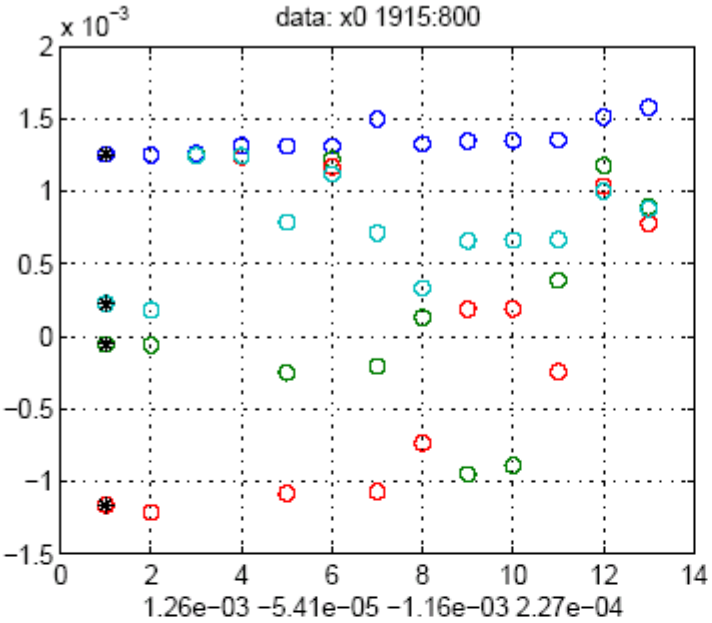
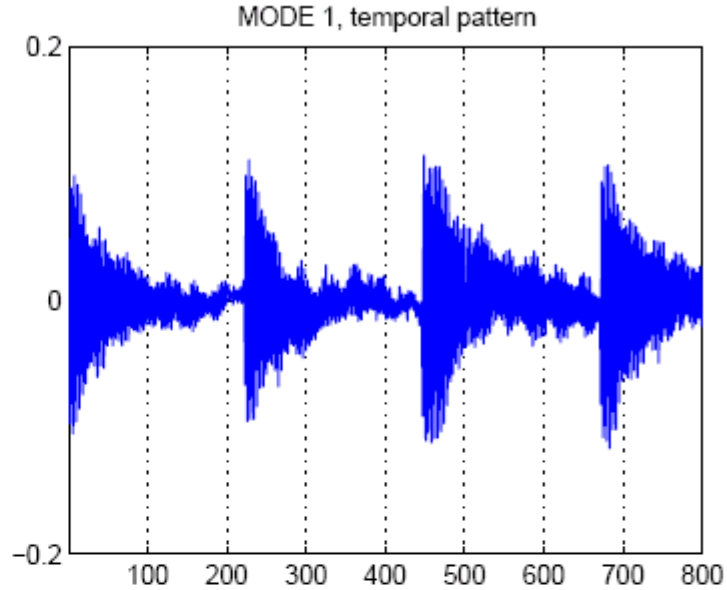
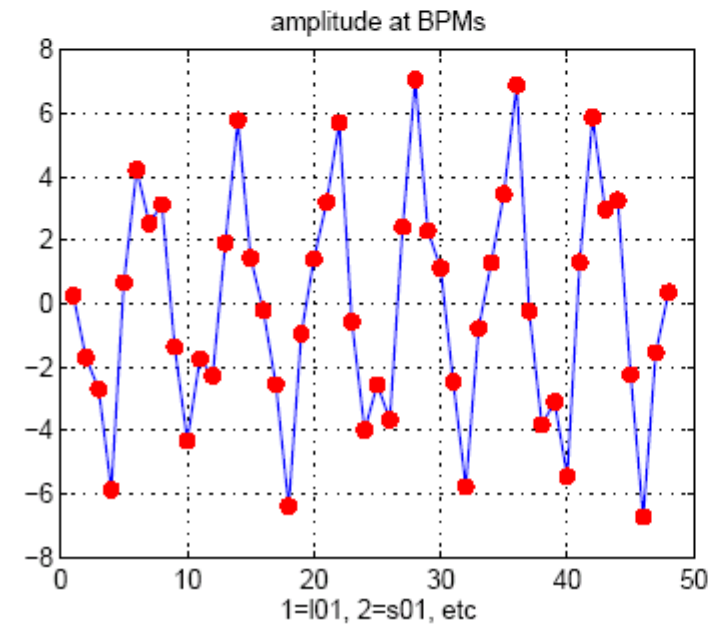
Use bi in para_v0

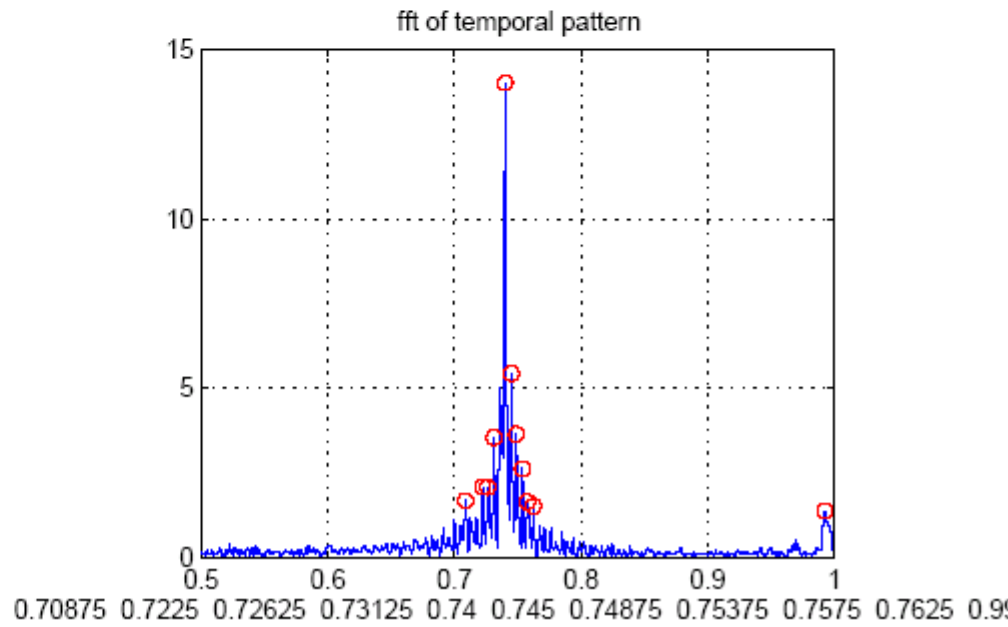












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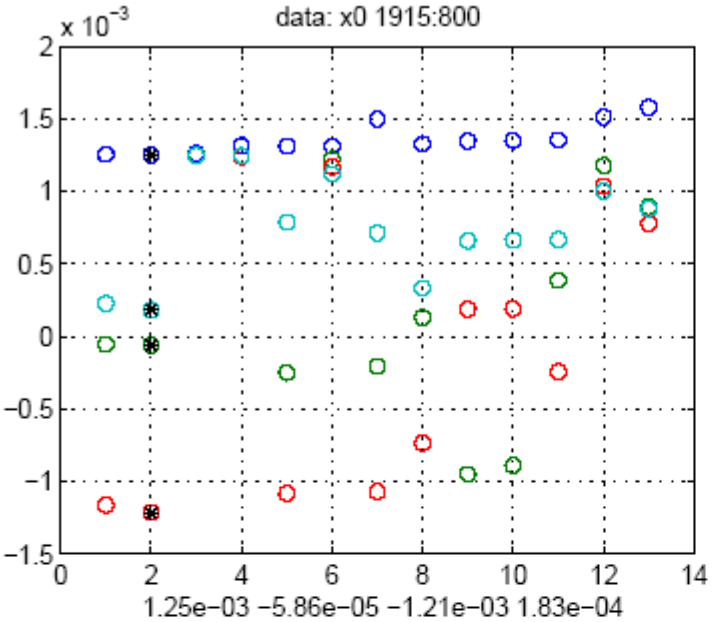

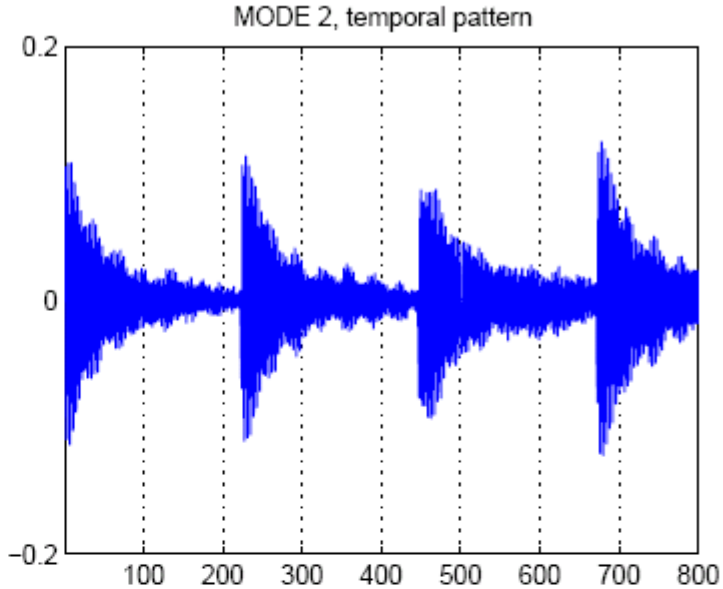

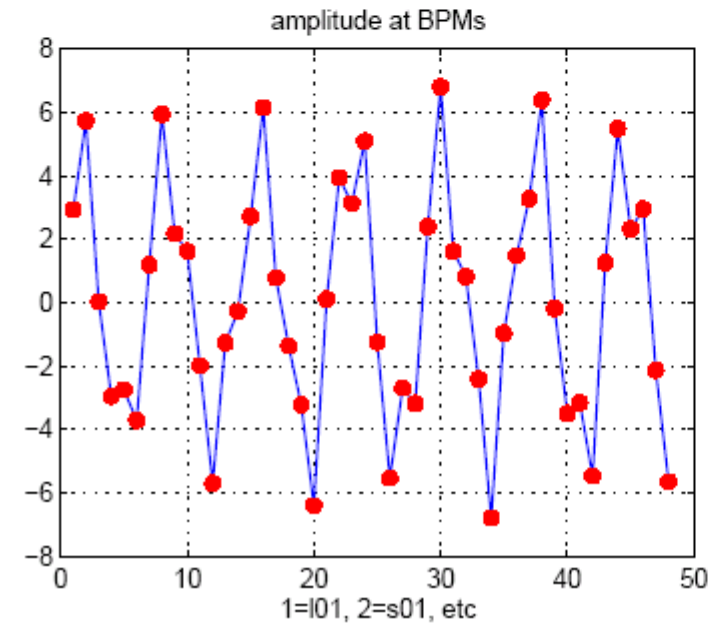

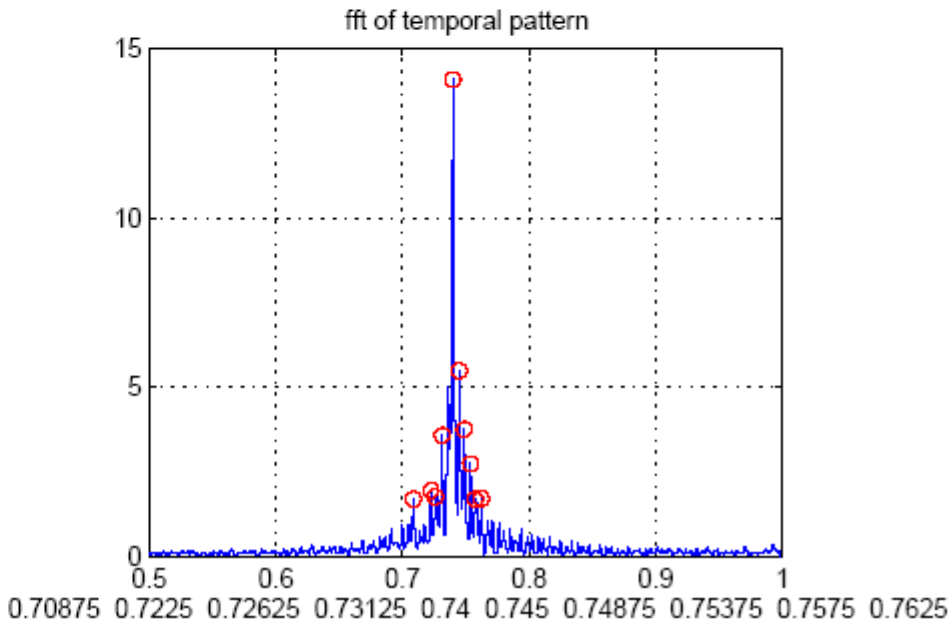

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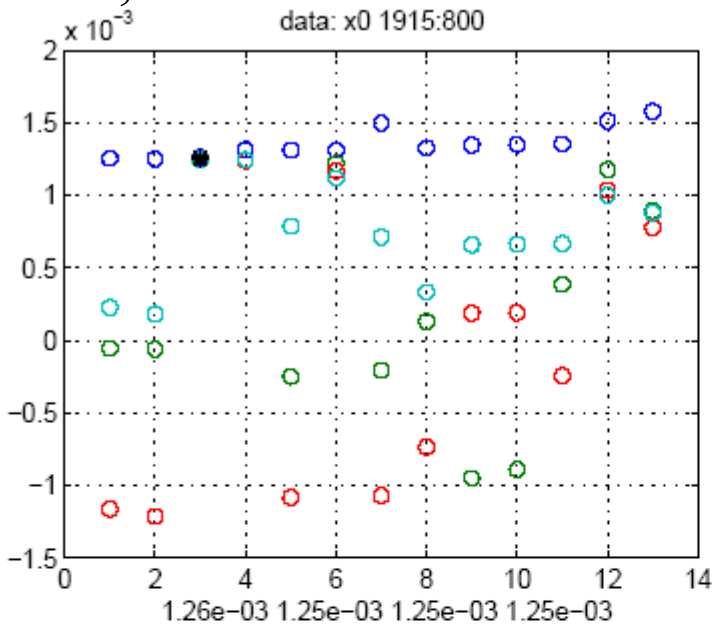
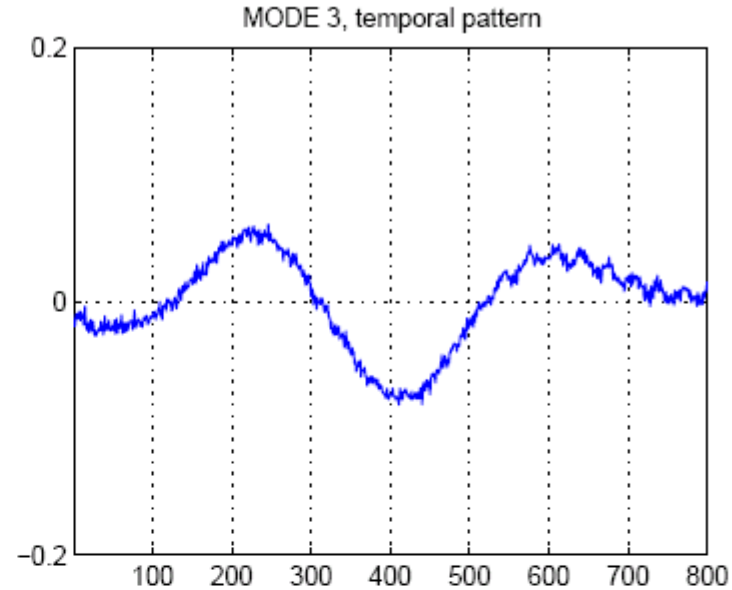
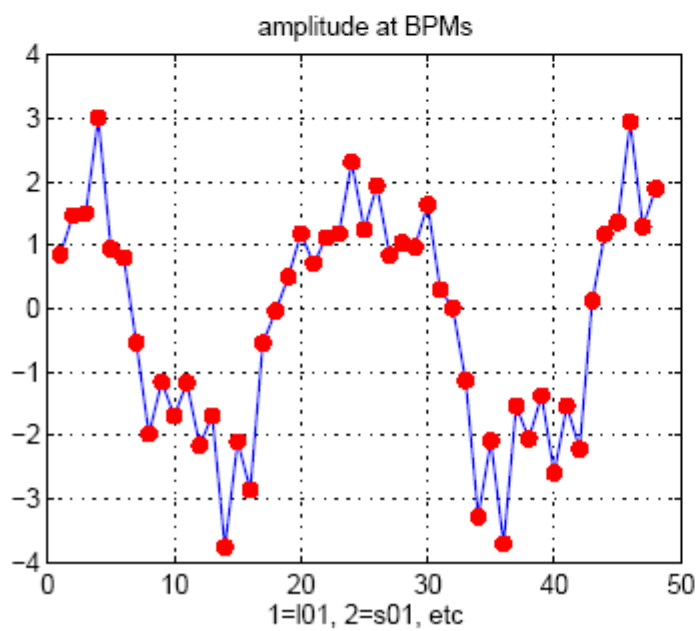
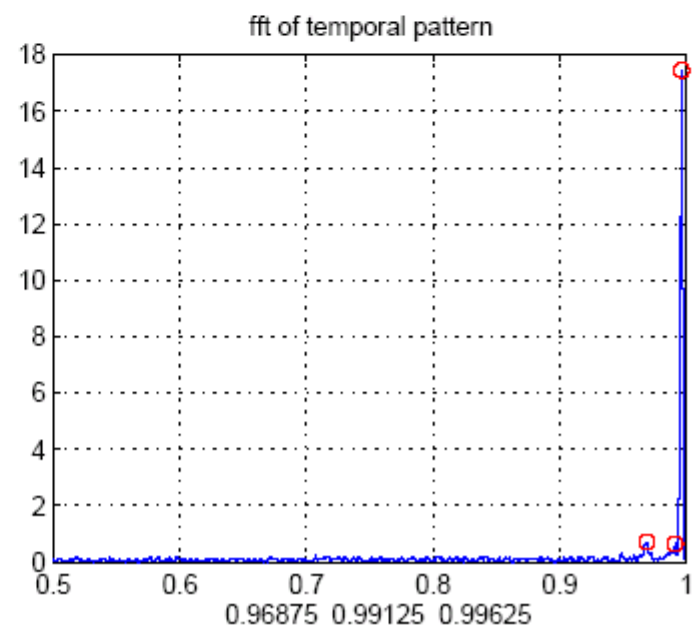
CA Mode 3; Honrizontal









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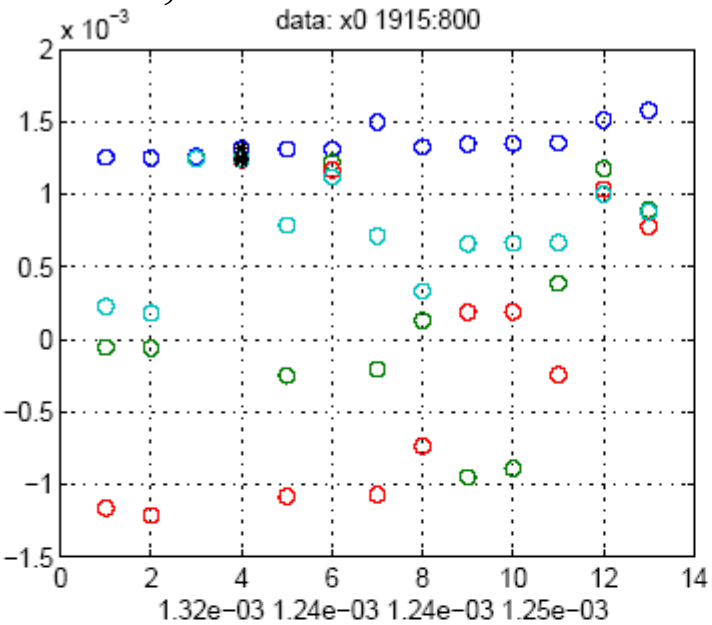
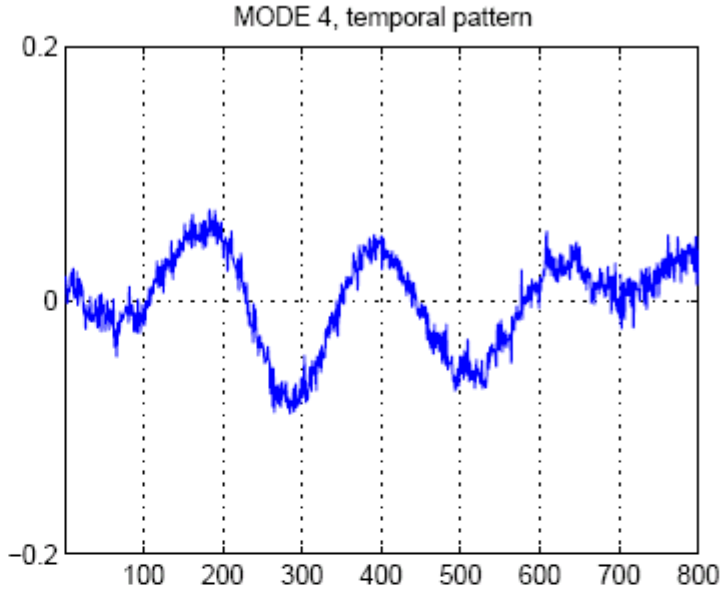
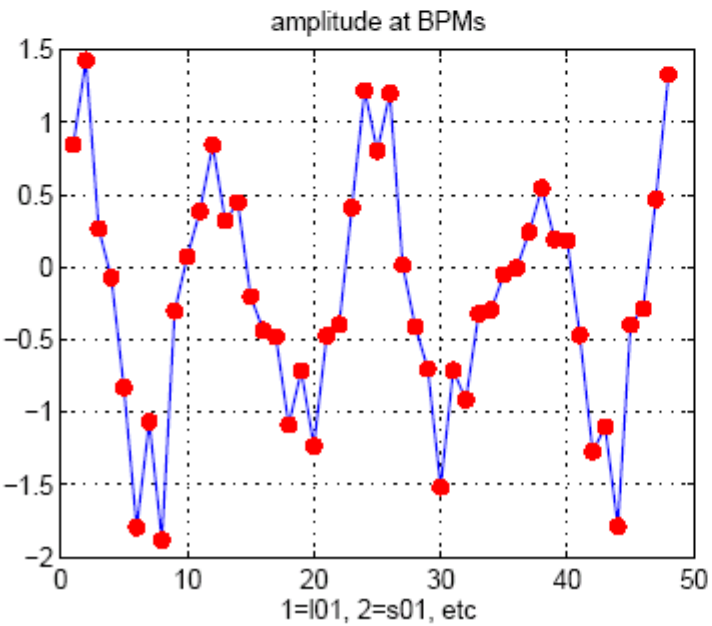
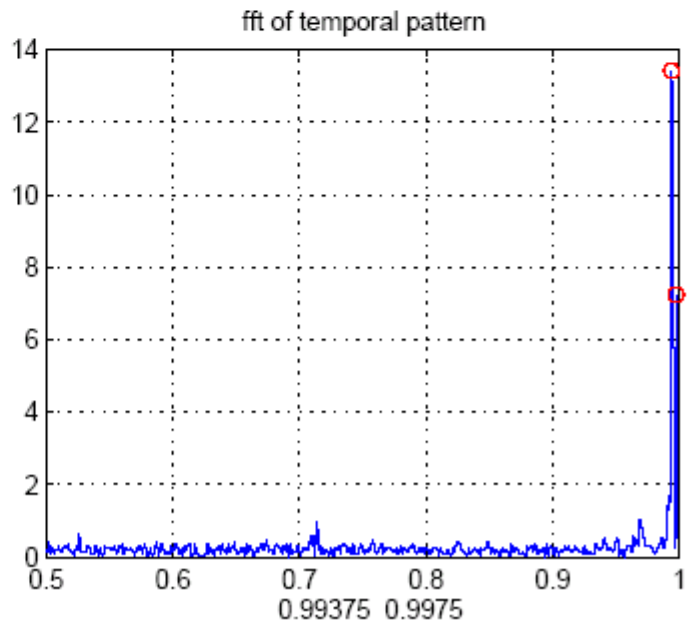
ICA Mode 4; Honrizontal









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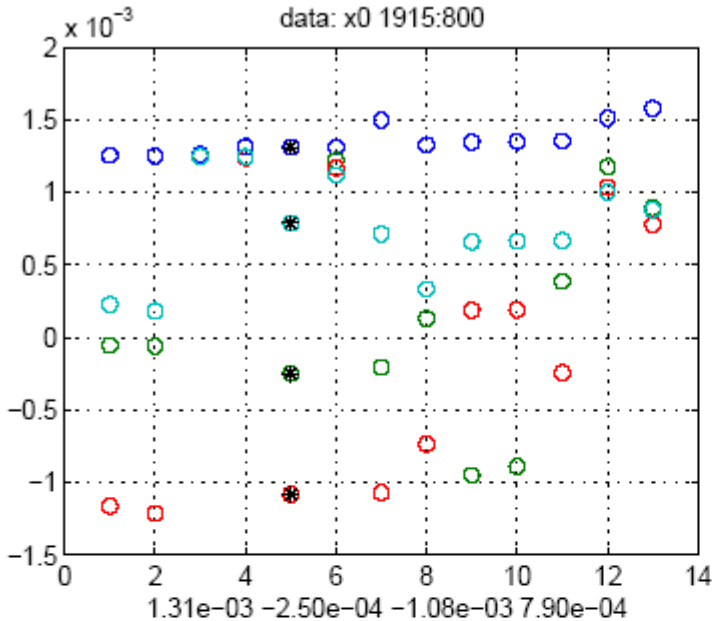

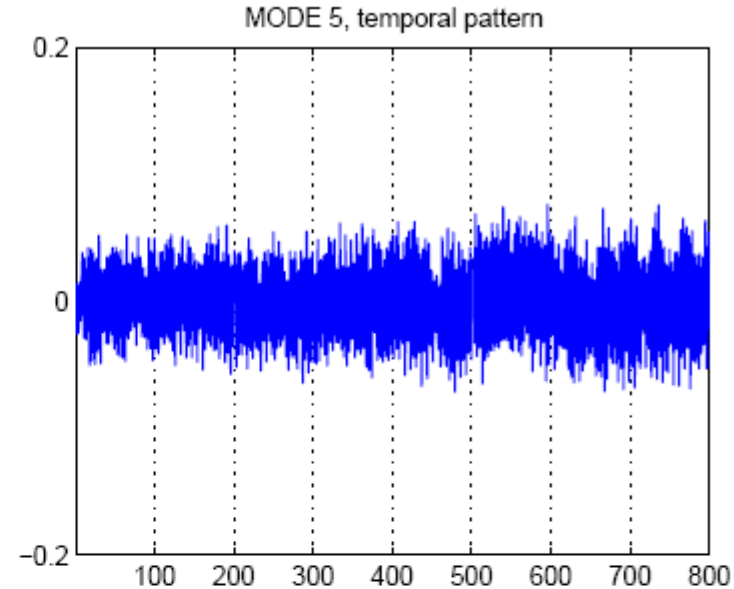

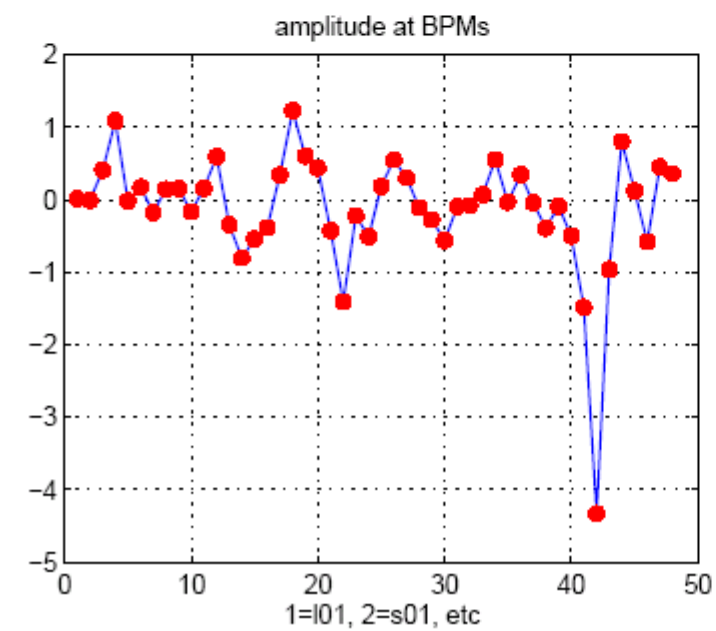

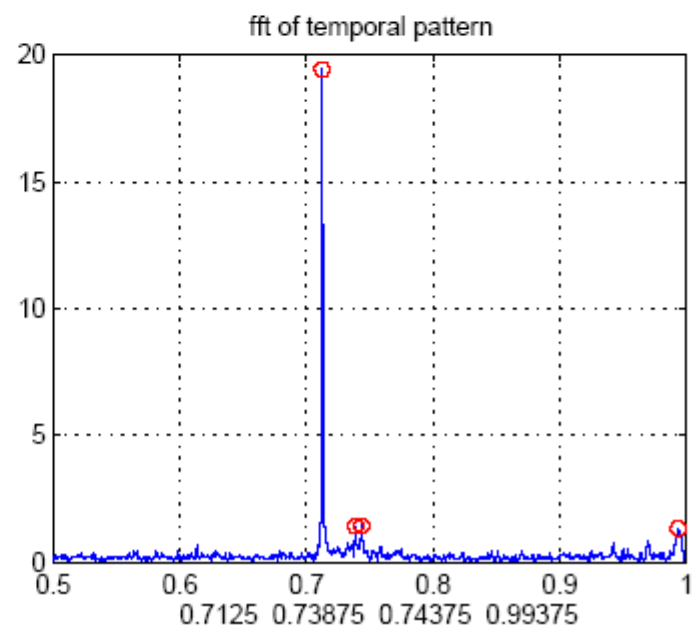

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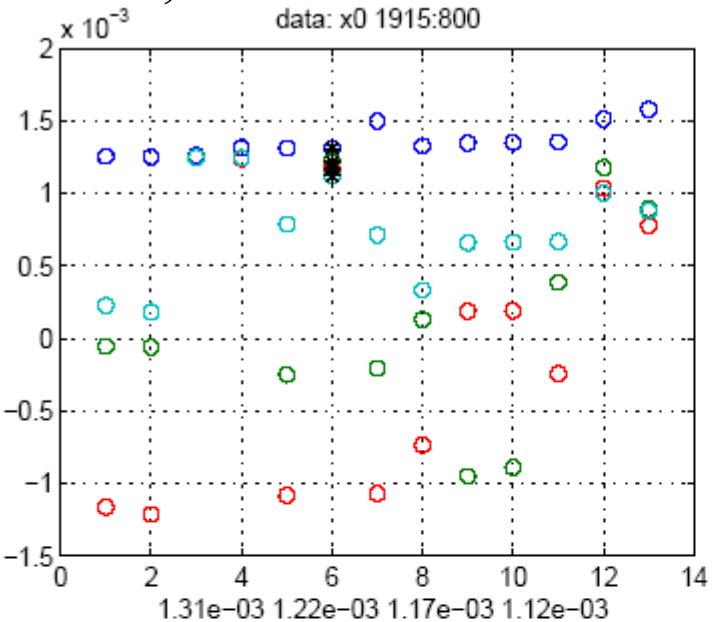
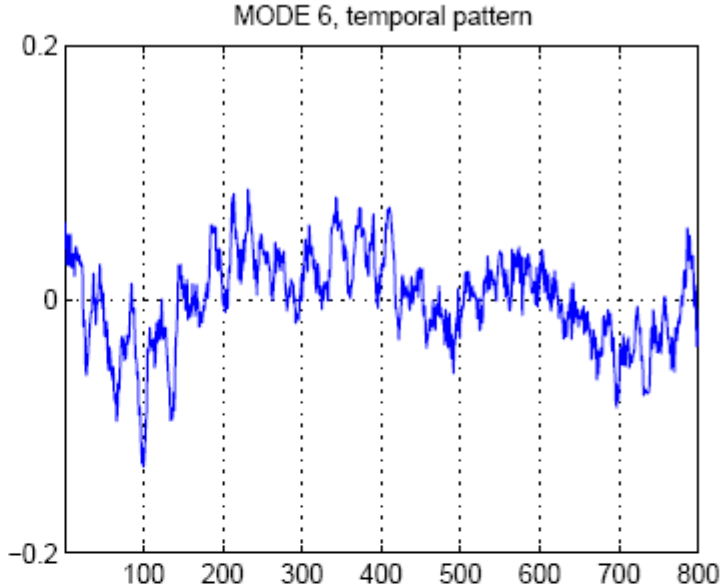
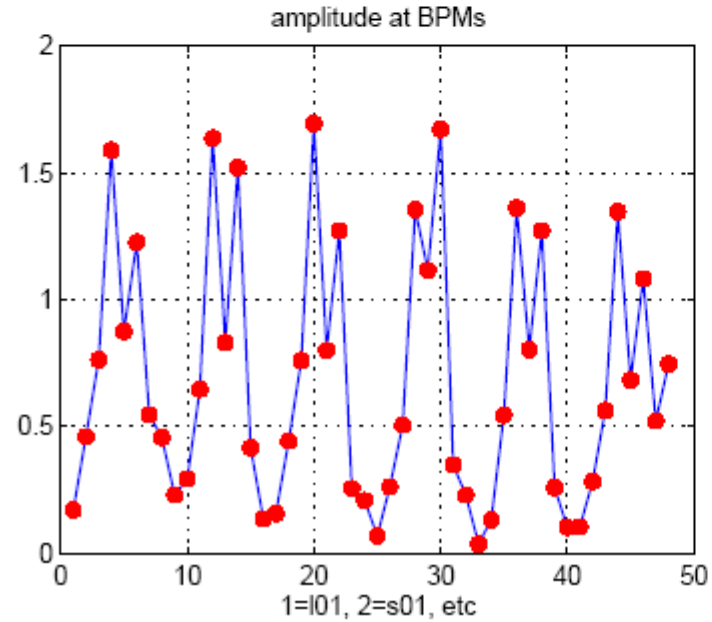
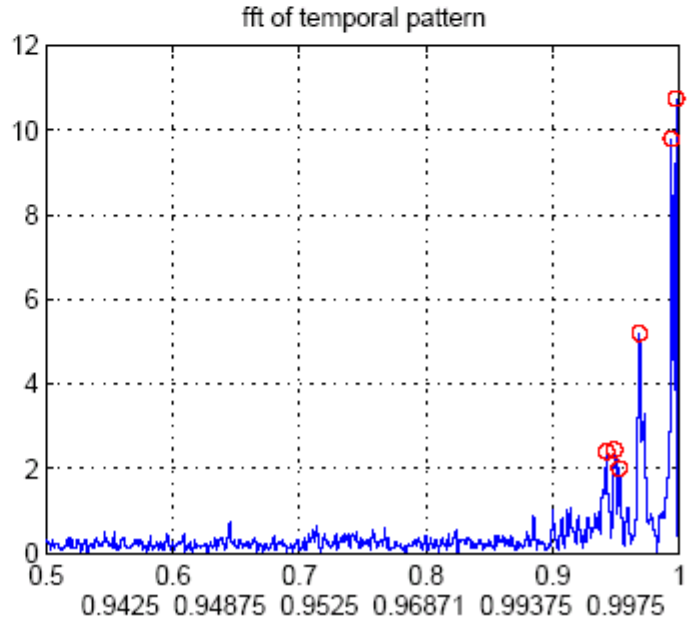
ICA Mode 6; Honrizontal









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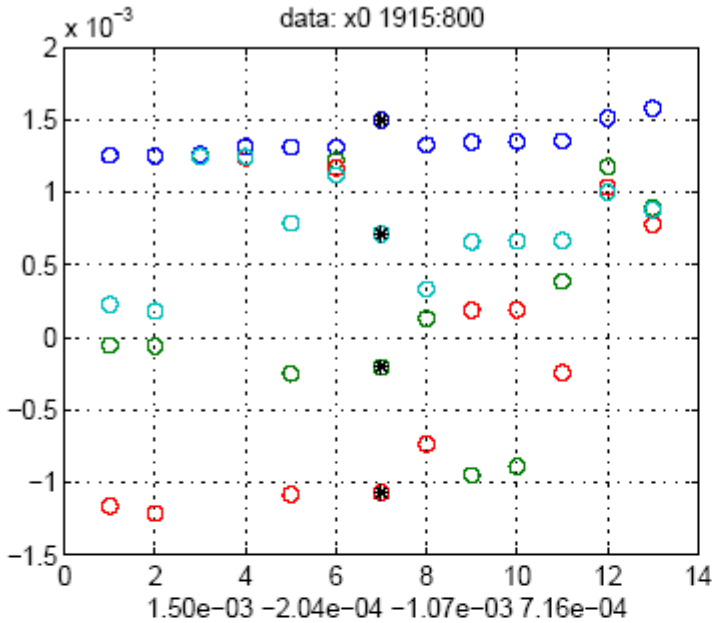

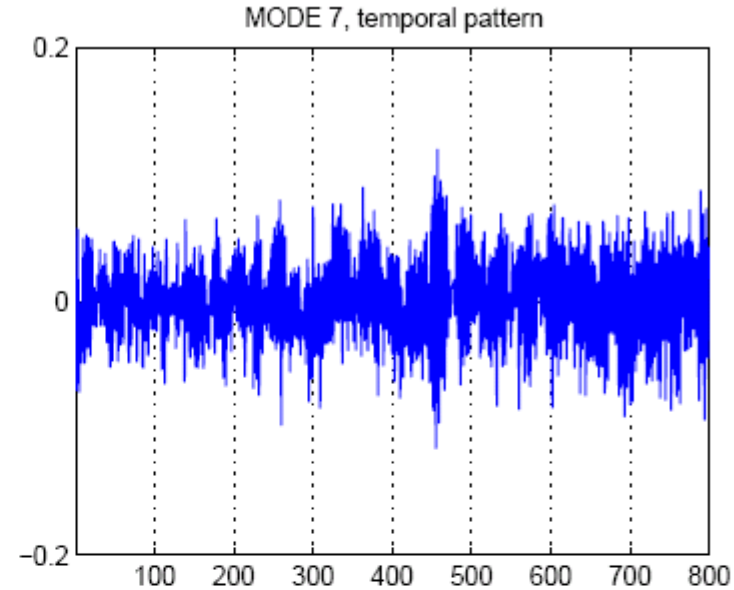

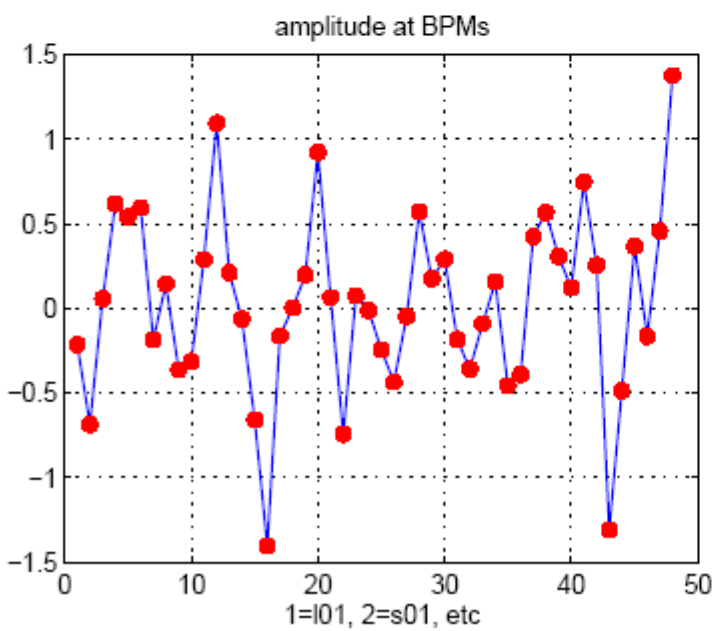

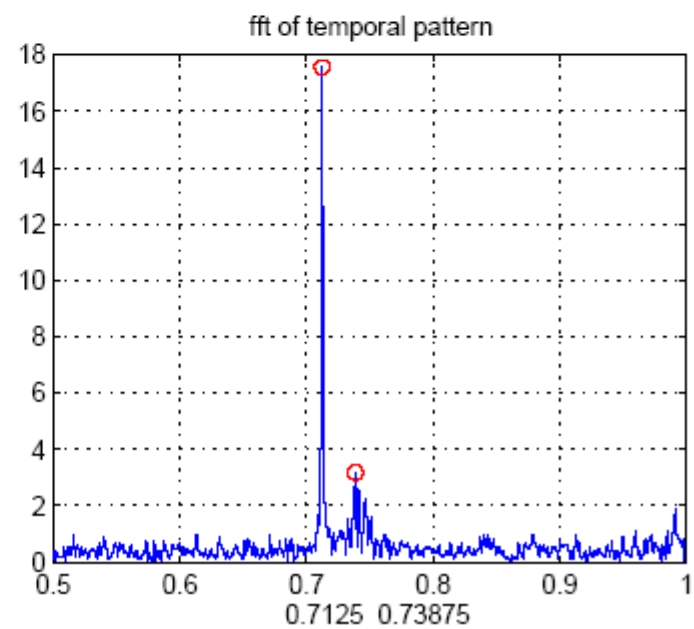

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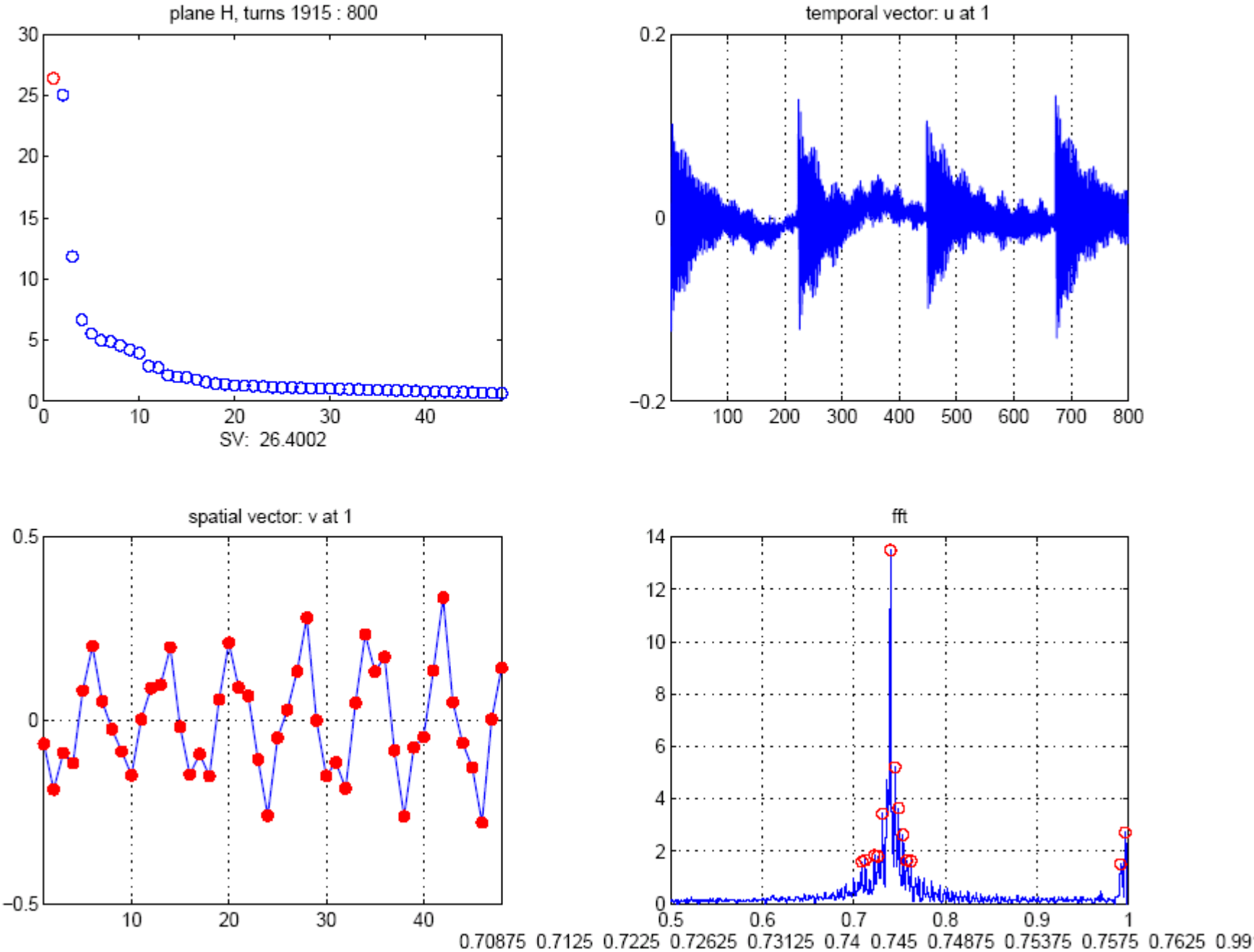
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SV: 26.4002
temporal vector: u at 1
spatial vector: v at 1
fft
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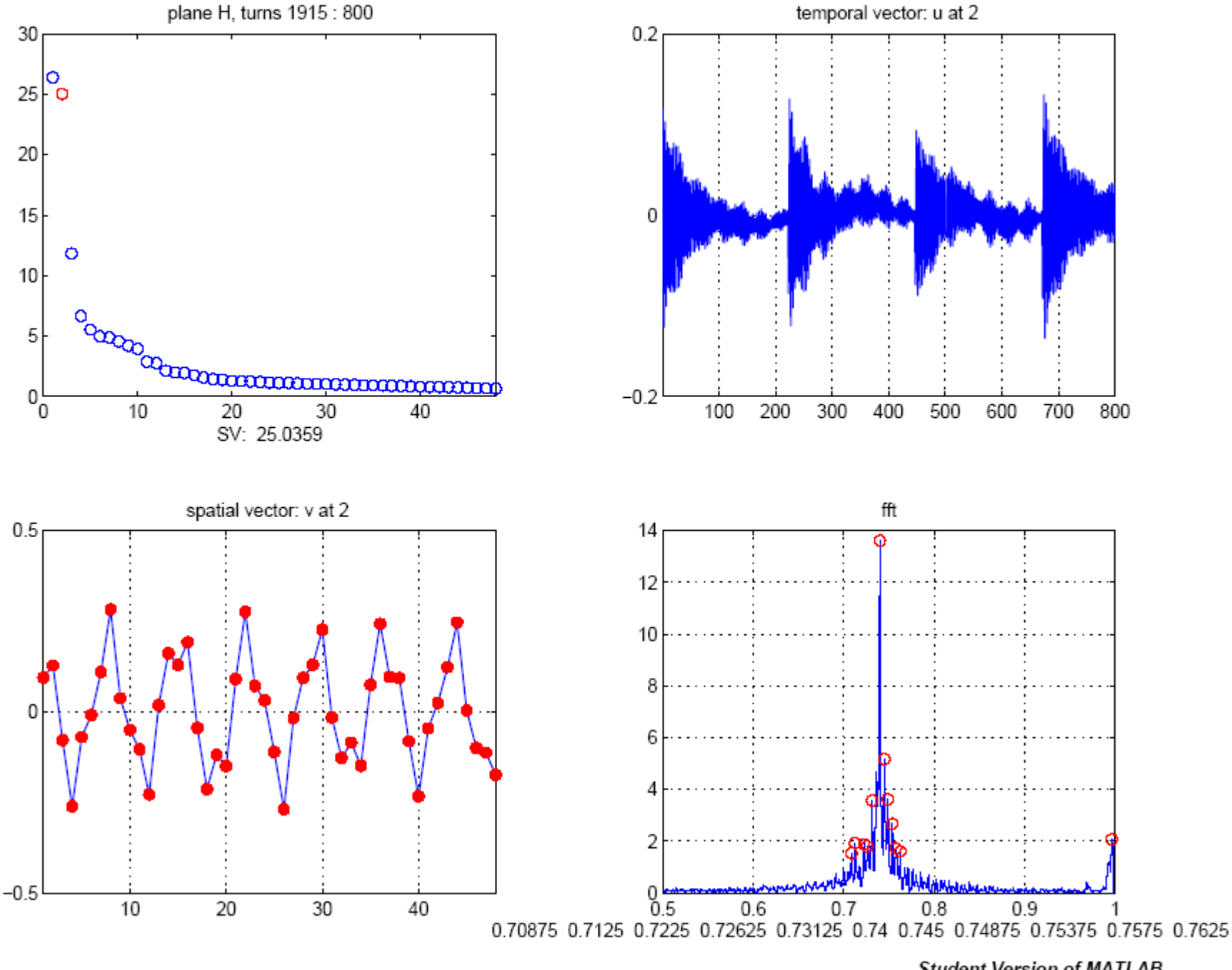
Student Version of MATLAB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spatial vector: v at 2
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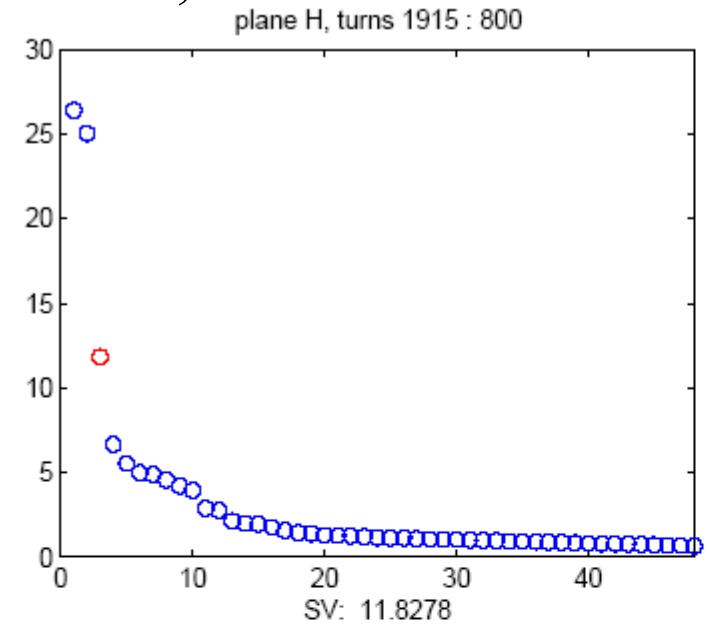
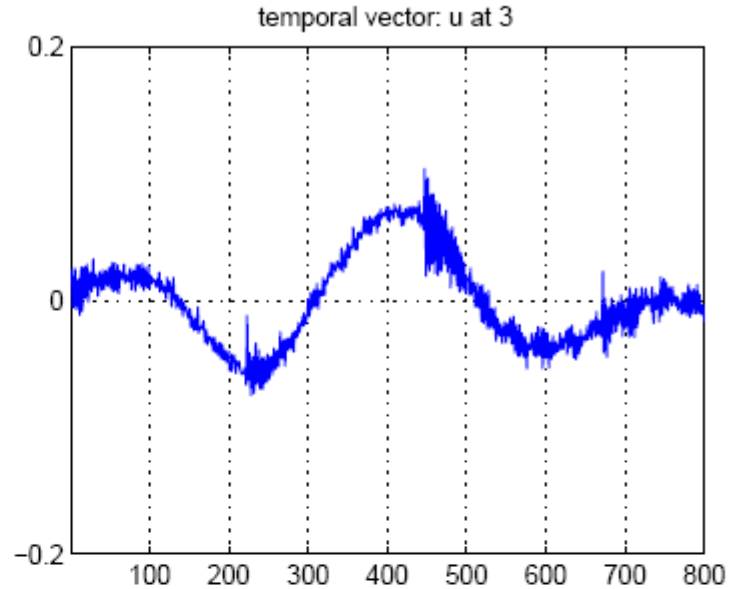
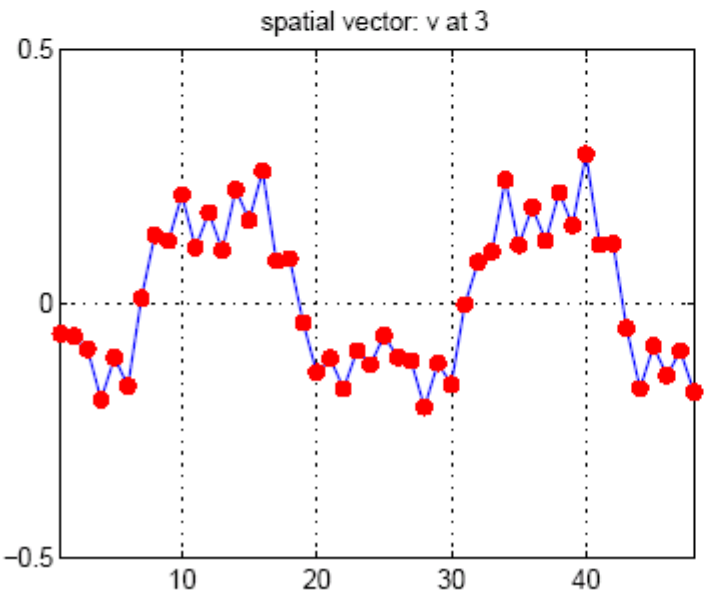
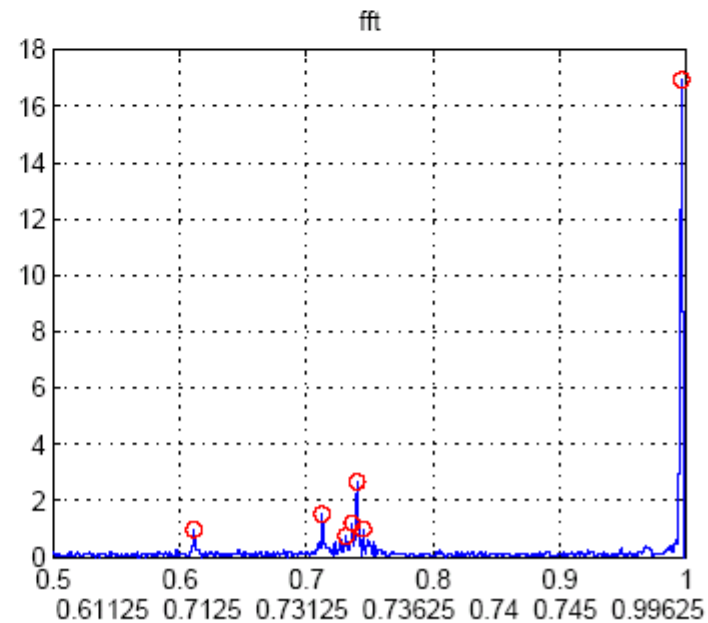
Student Version of MATLAB

MIA Mode 3; Honrizontal



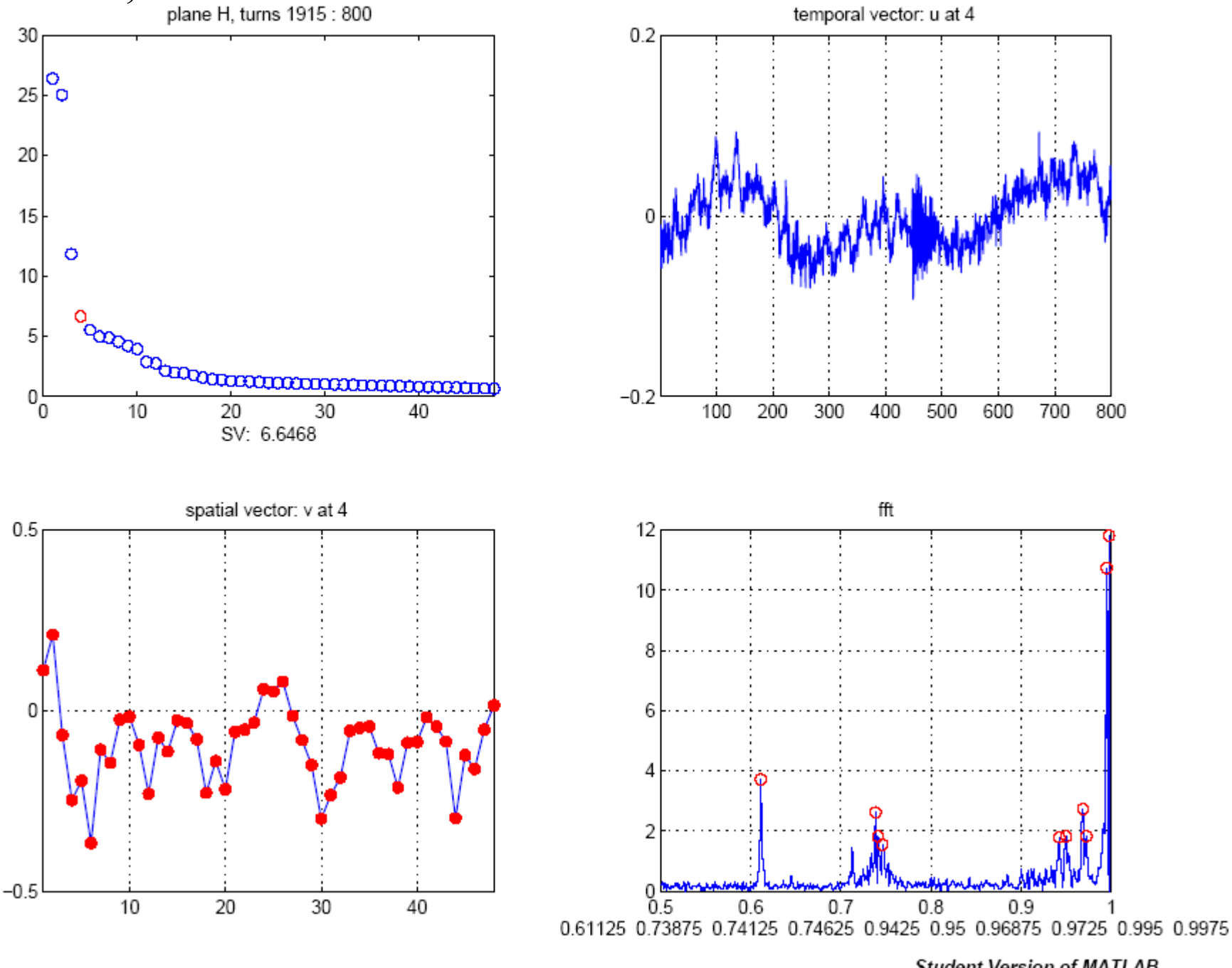


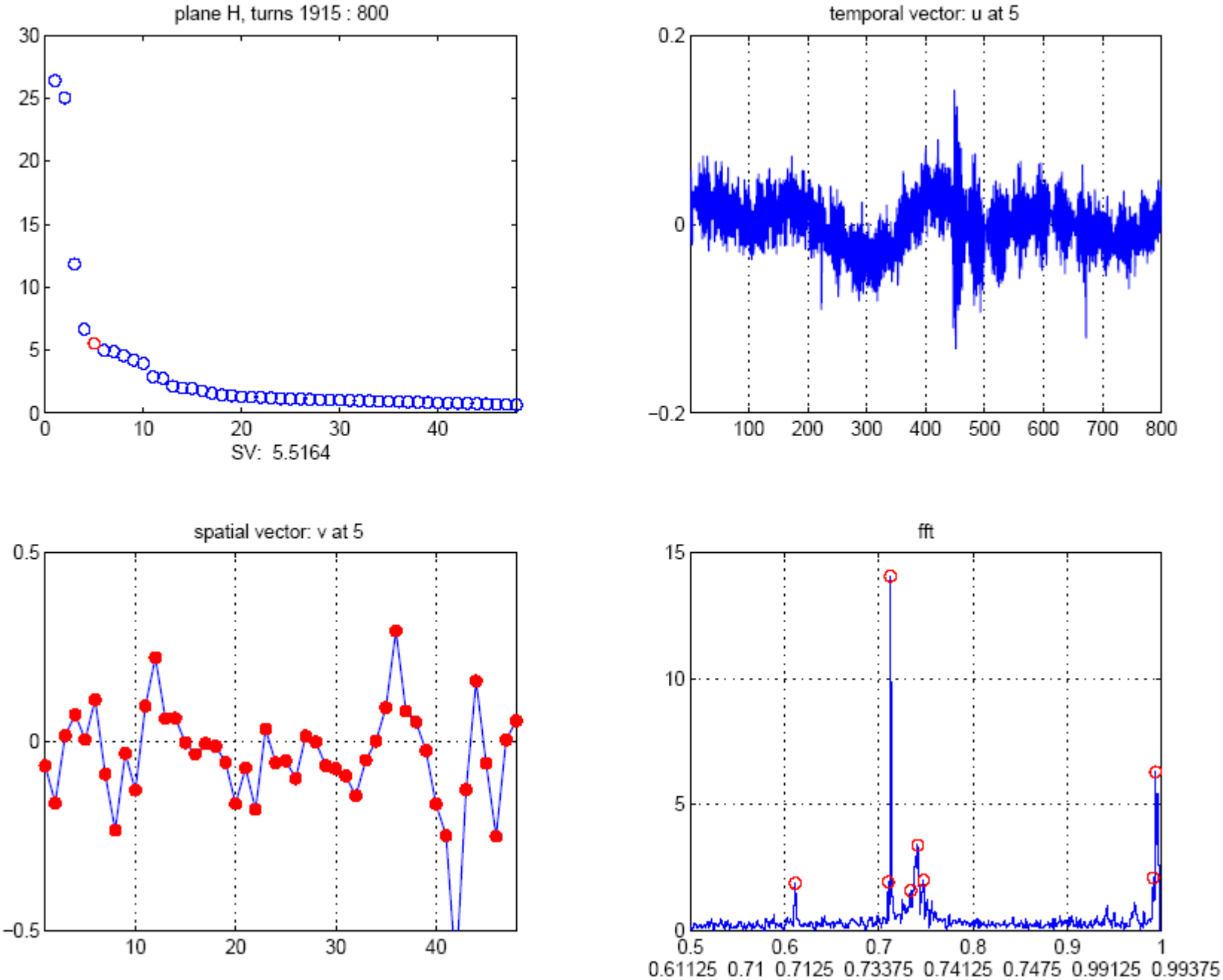




Student Version of MATLAB

MIA Mode 4; Honrizontal

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SV: 5.5164
temporal vector: u at 5
spatial vector: v at 5
fft
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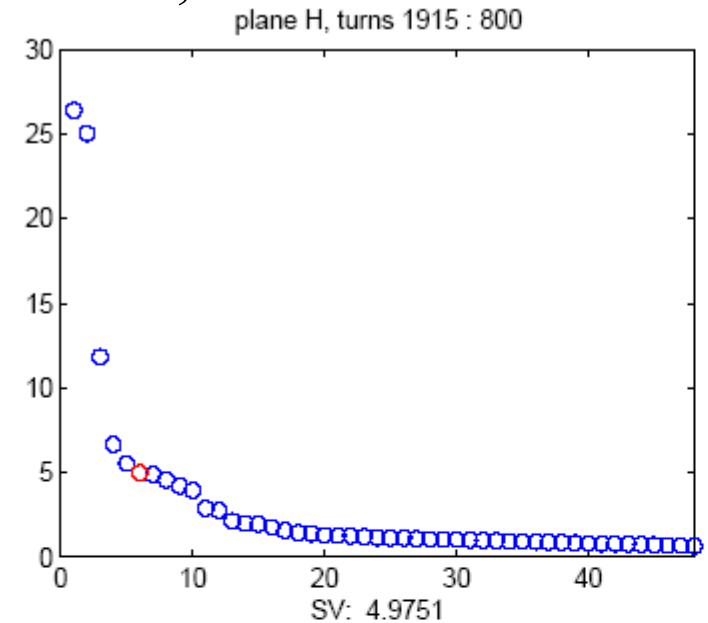
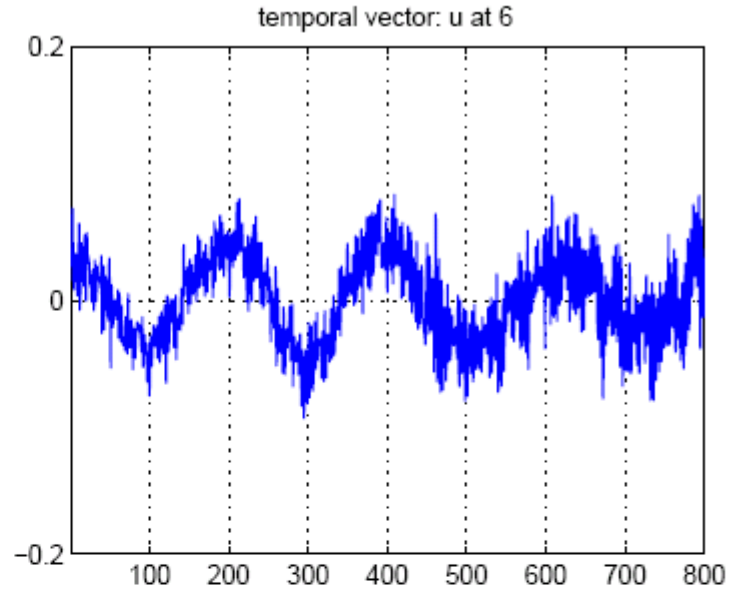
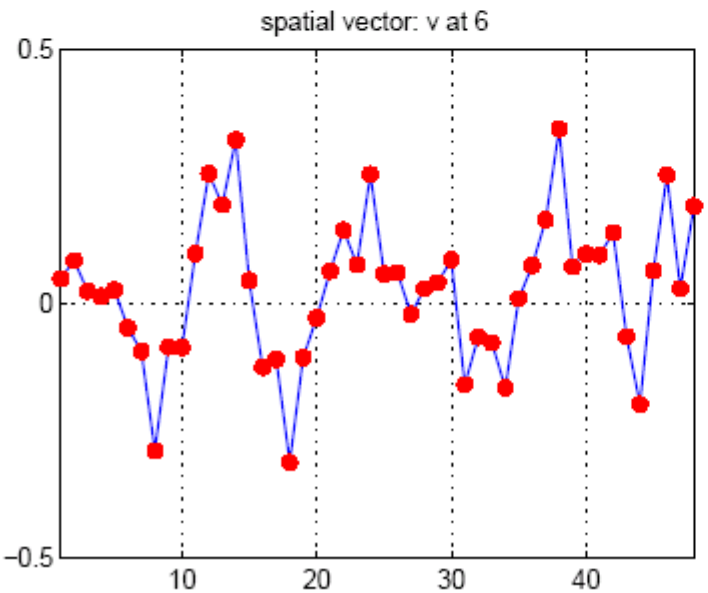
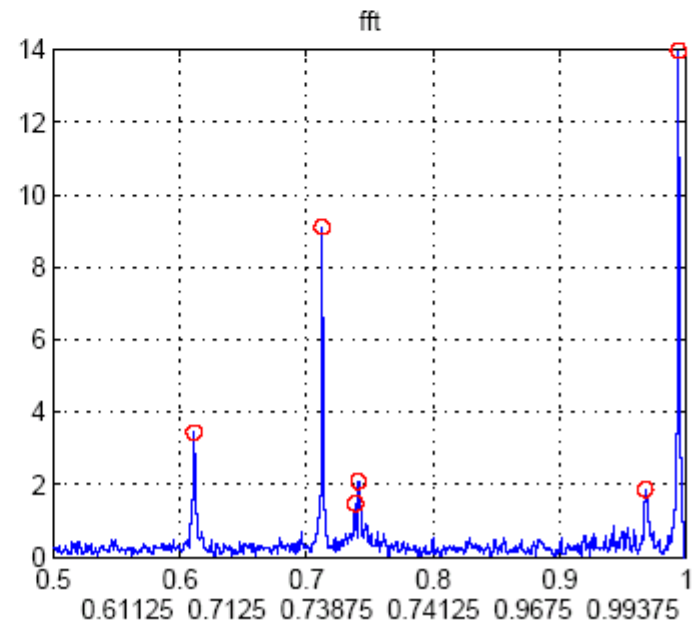
Student Version of MATLAB

MIA Mode 6; Honrizontal

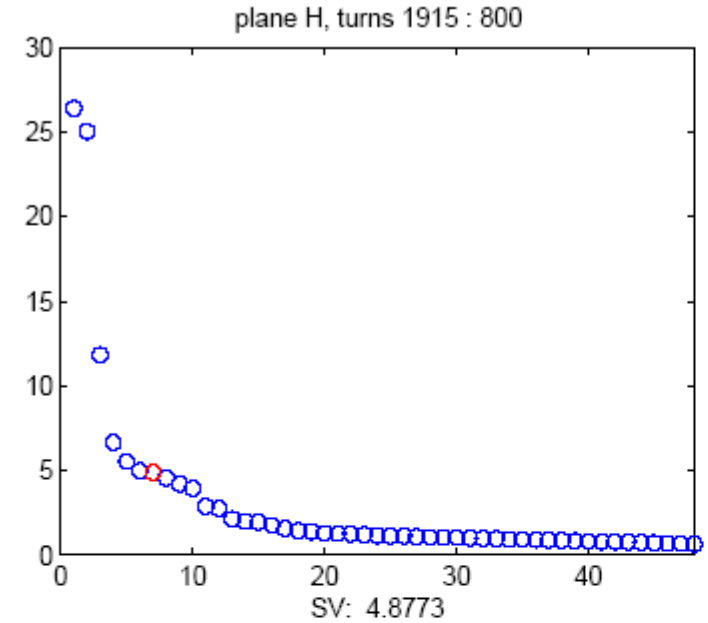


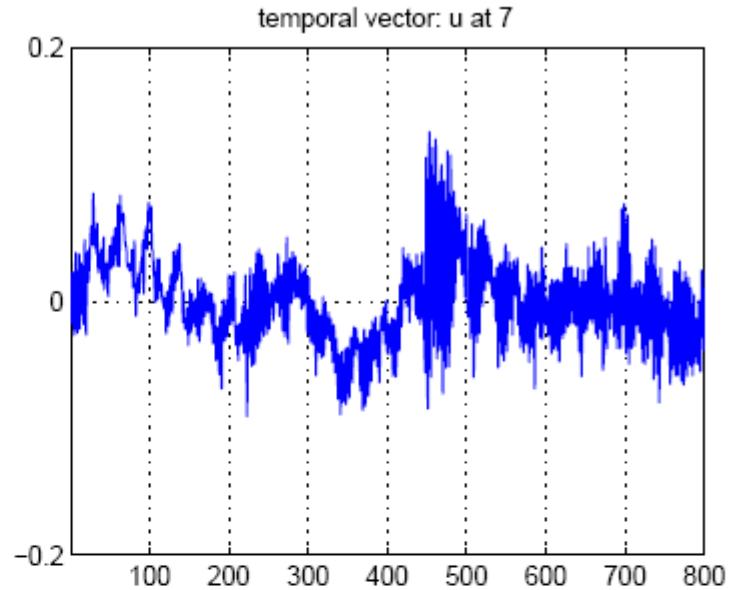


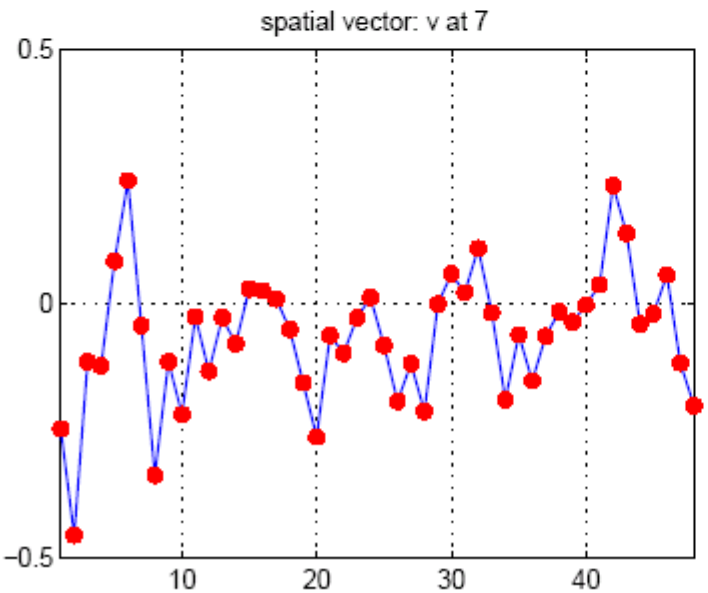


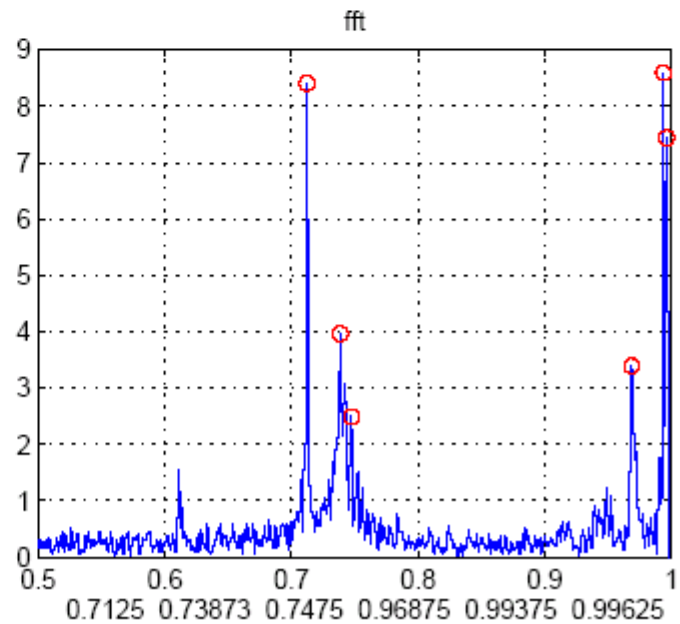


Student Version of MATLAB

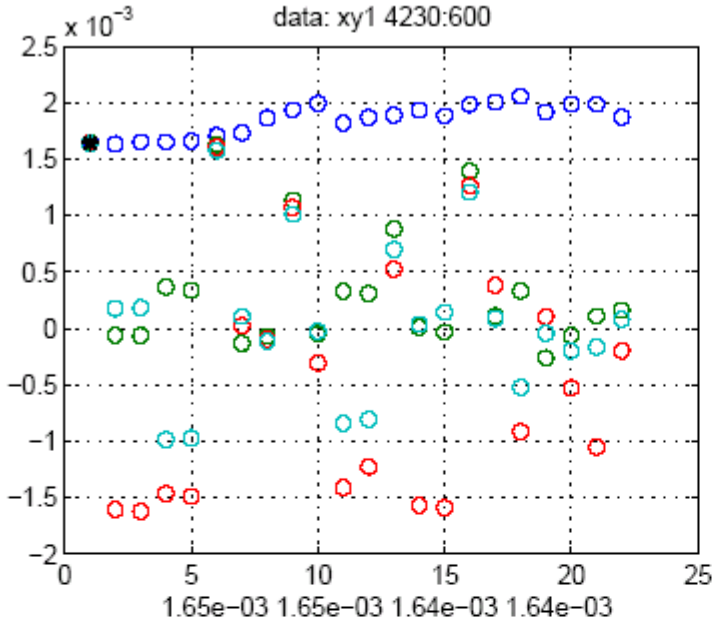


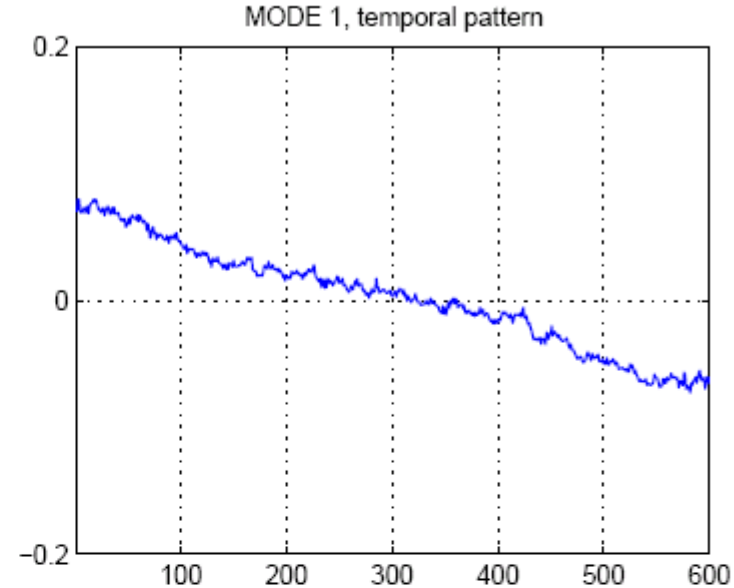


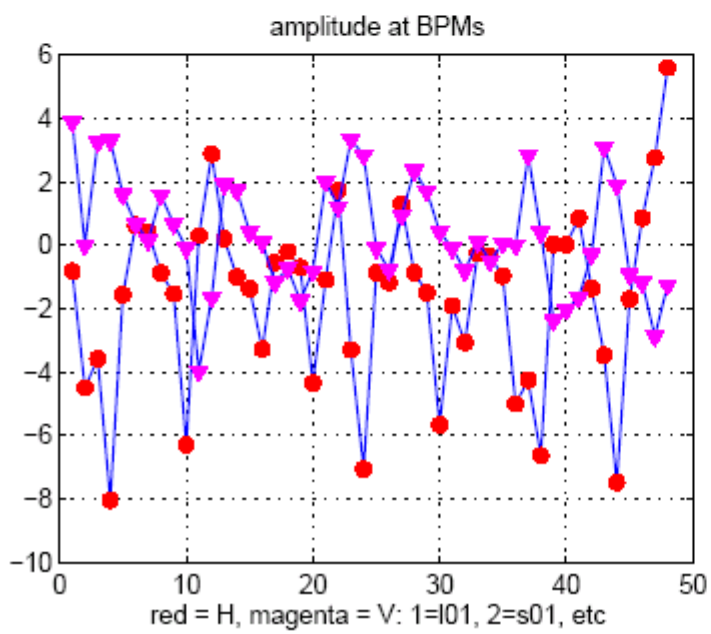


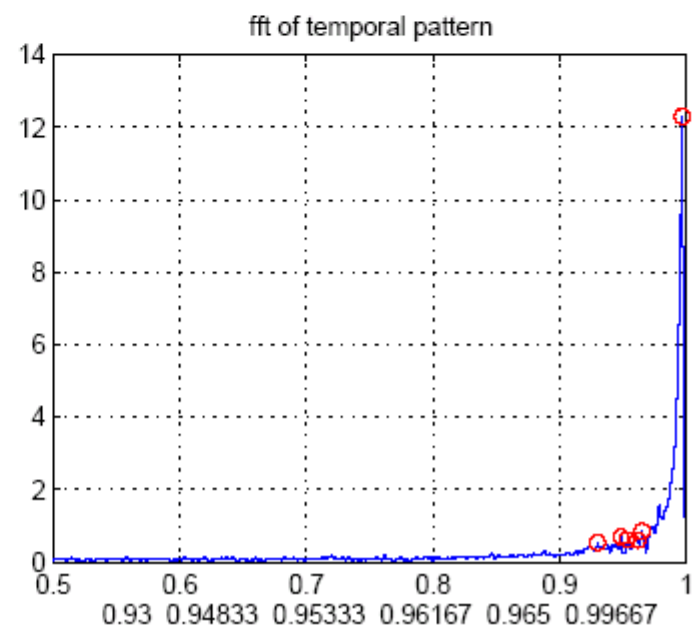


Student Version of MATLAB

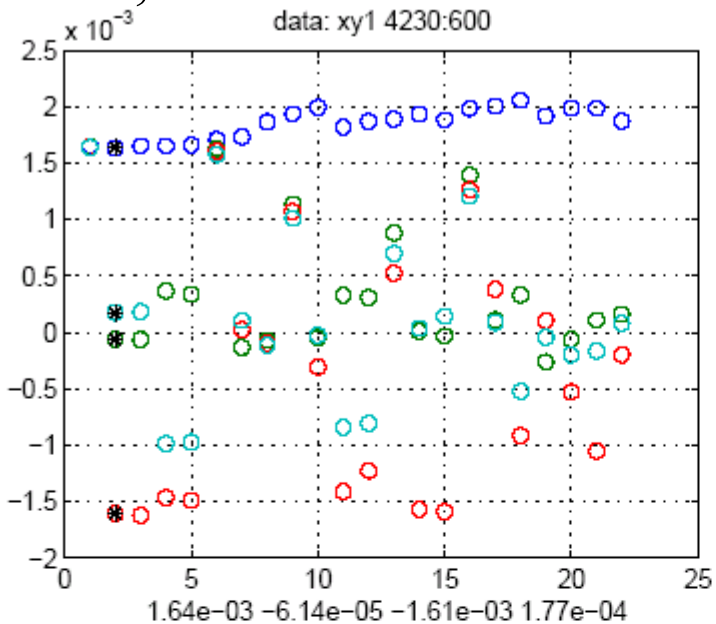

data: xy1 4230:600
x 10^-3
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
0
5
10
15
20
25
1.65e−03 1.65e−03 1.64e−03 1.64e−03

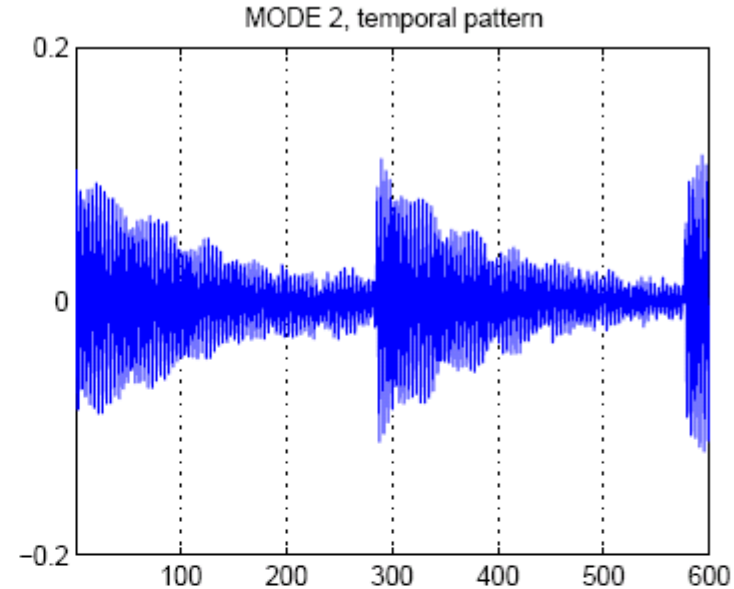

MODE 1, temporal pattern
0.2
0
−0.2
100
200
300
400
500
600

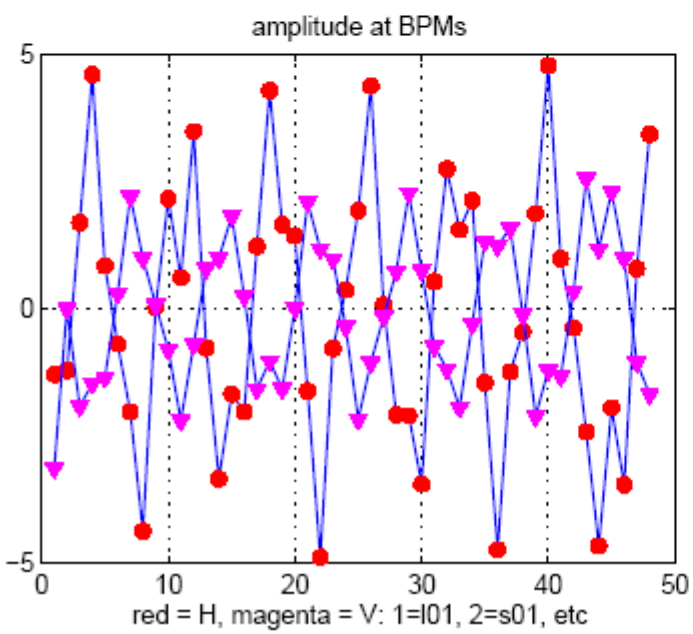

amplitude at BPMs
6
4
2
0
−2
−4
−6
−8
−10
0
10
20
30
40
50
red = H, magenta = V: 1=l01, 2=s01, etc

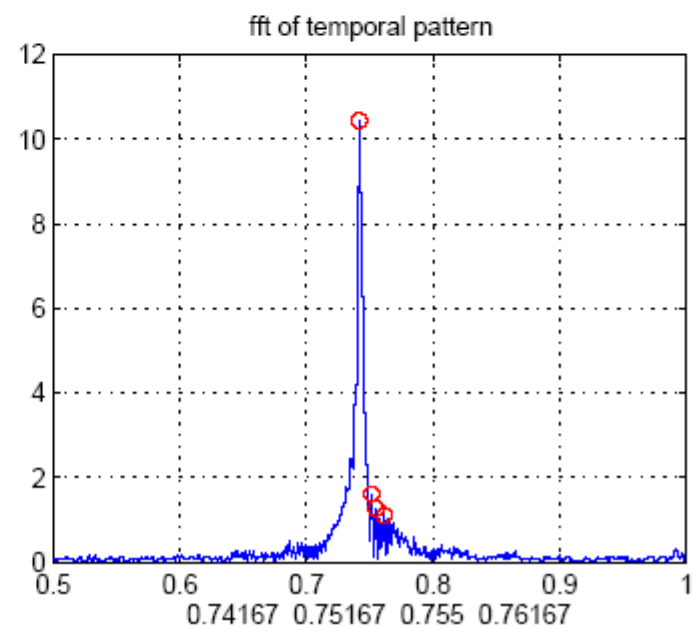

fft of temporal pattern
14
12
10
8
6
4
2
0
0.5
0.6
0.7
0.8
0.9
1
0.93 0.94833 0.95333 0.96167 0.965 0.99667

CA Mode 2; before shutdown

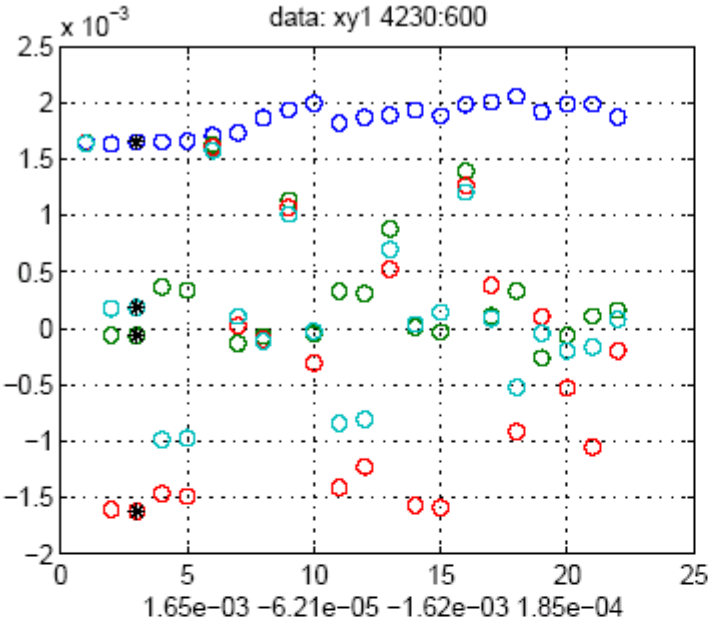


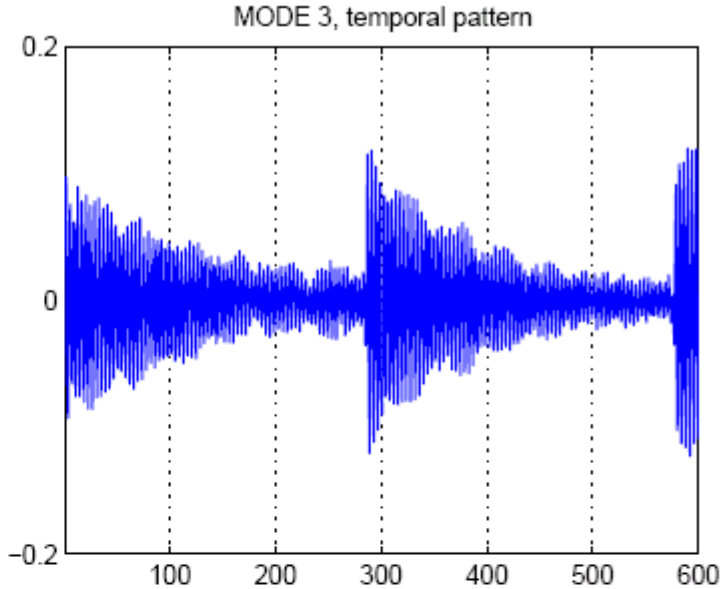


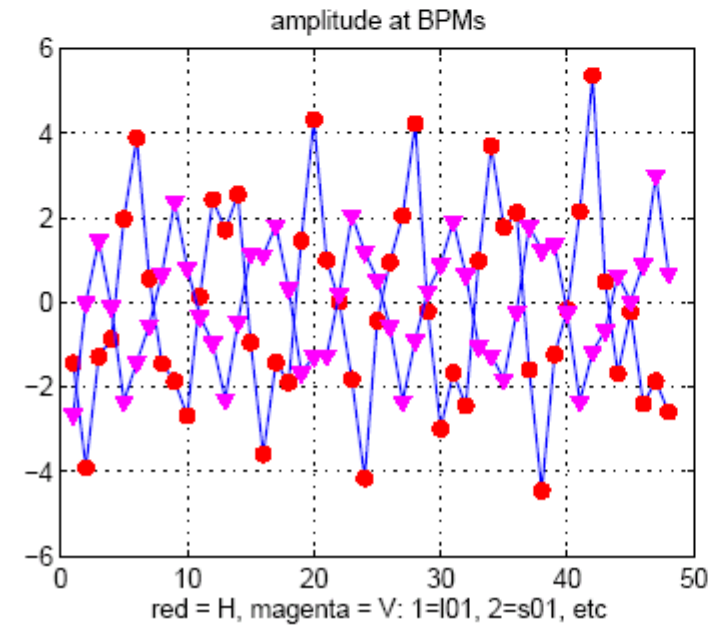


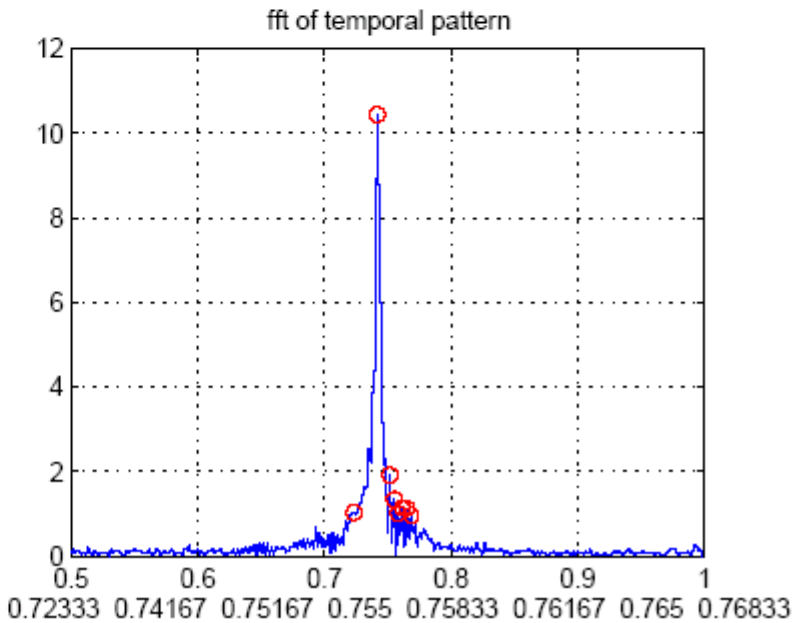


Student Version of MATLAB









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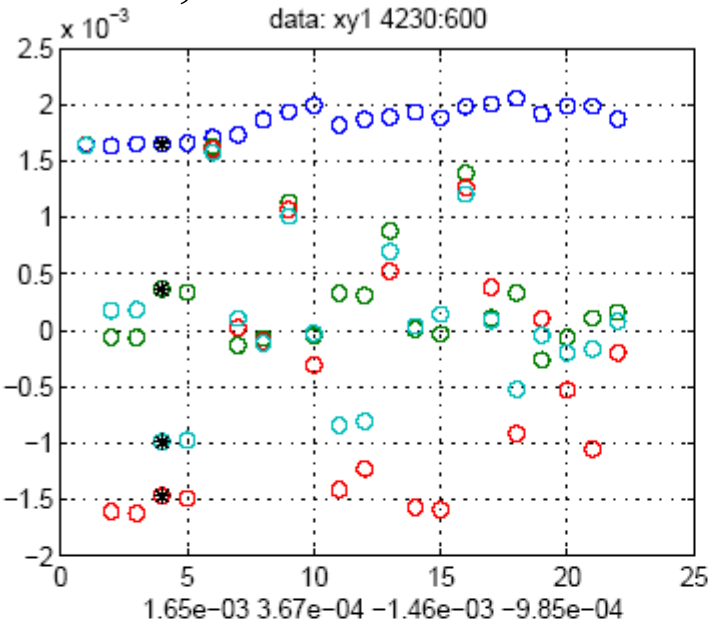
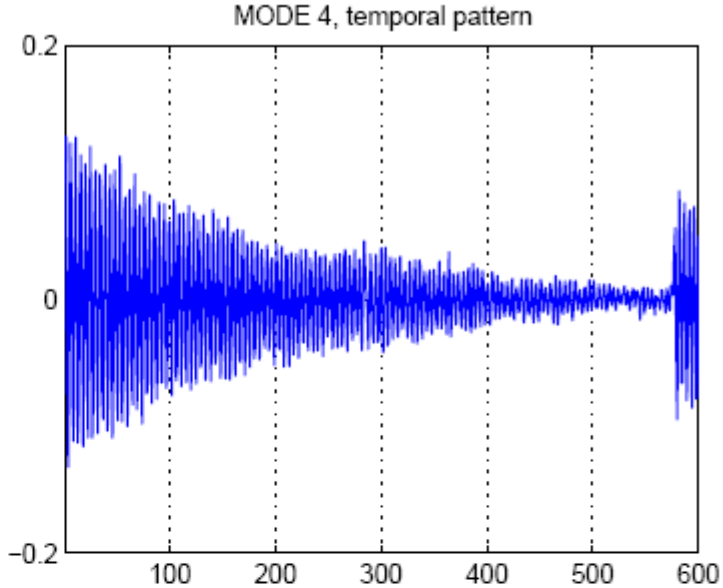
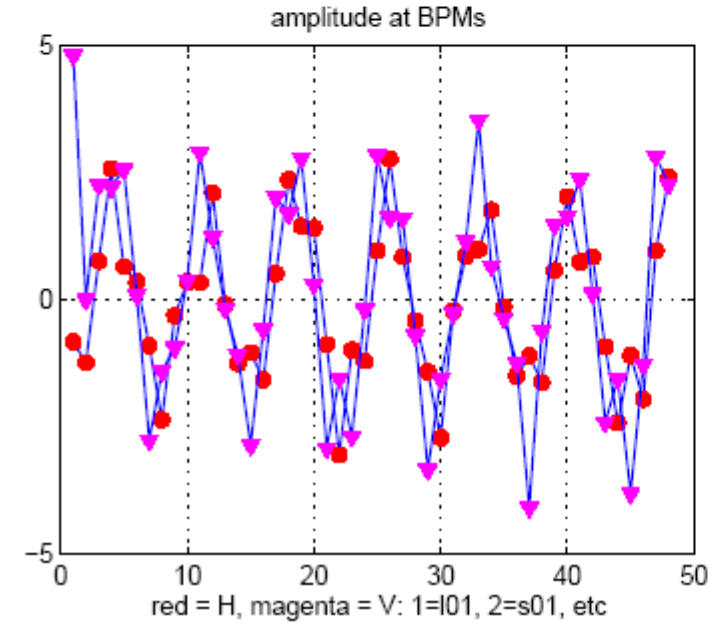
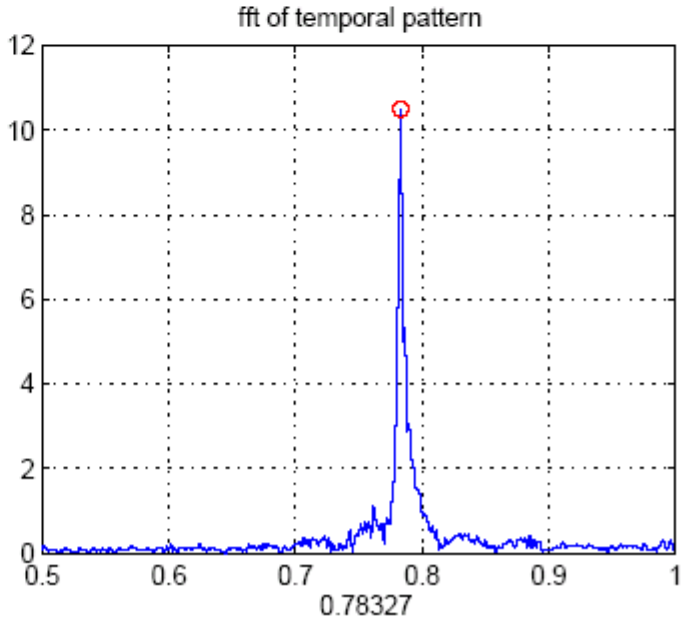
ICA Mode 4; before shutdown



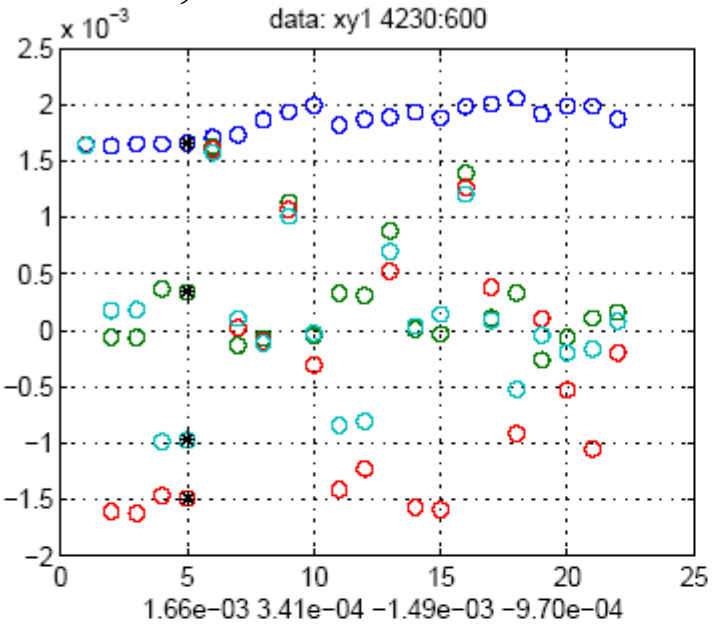


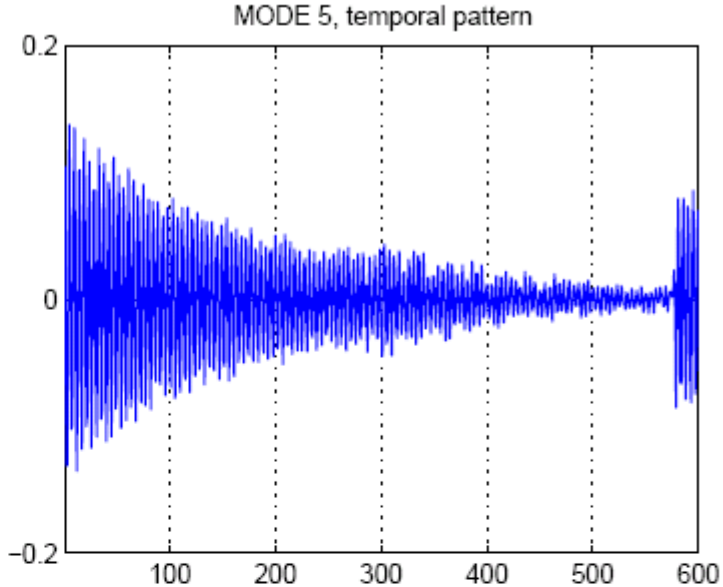


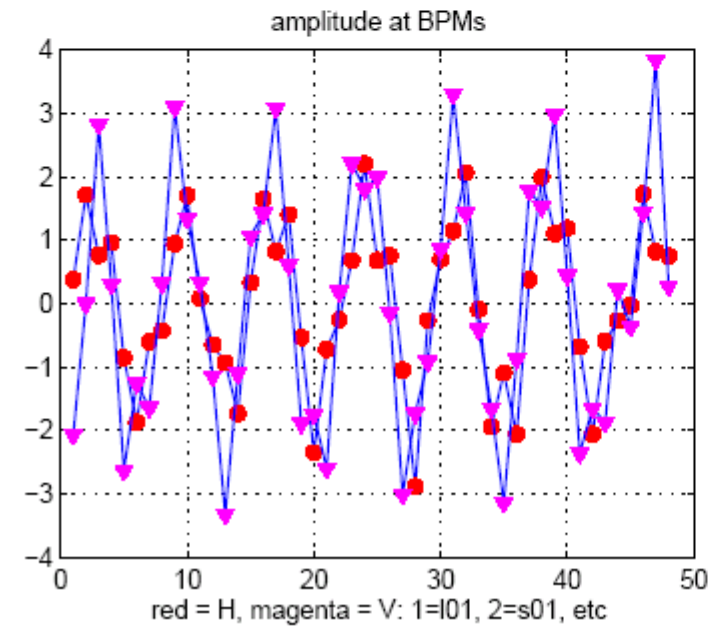


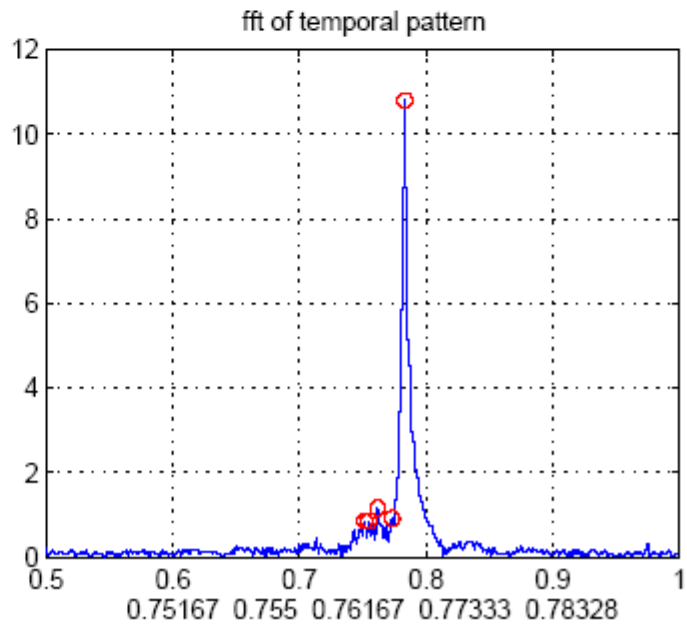
Student Version of MATLAB

ICA Mode 5; before shutdown









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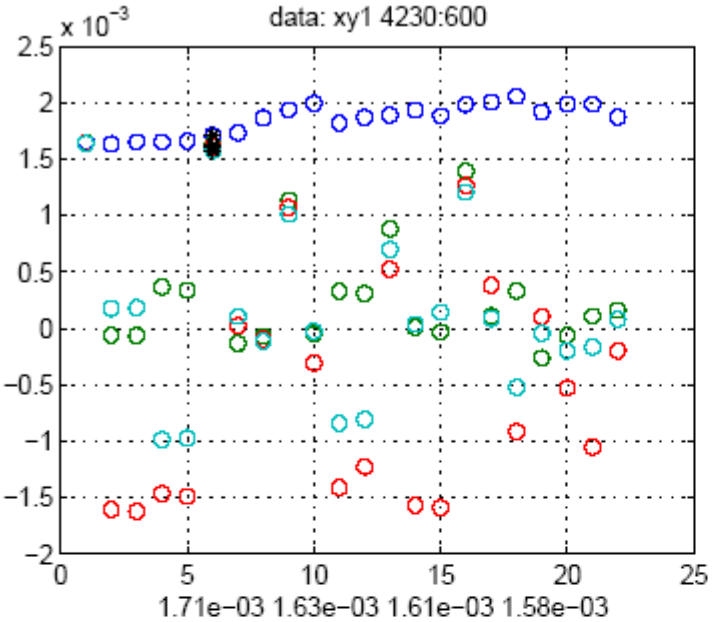

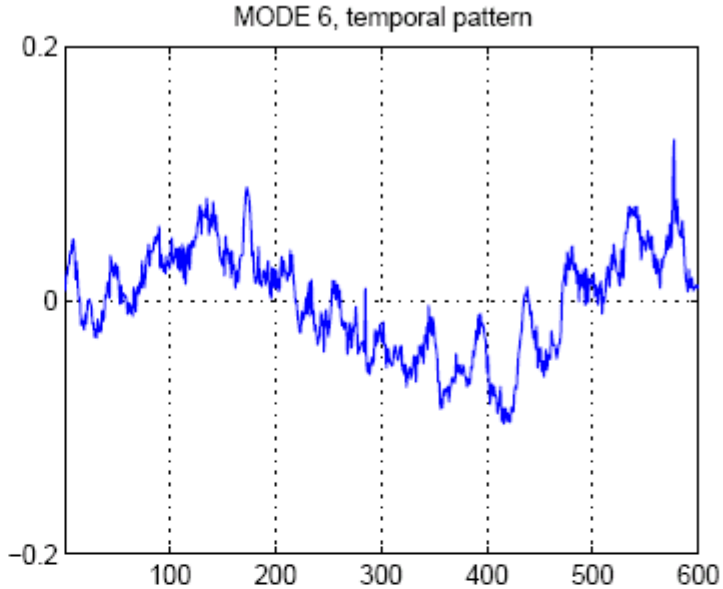

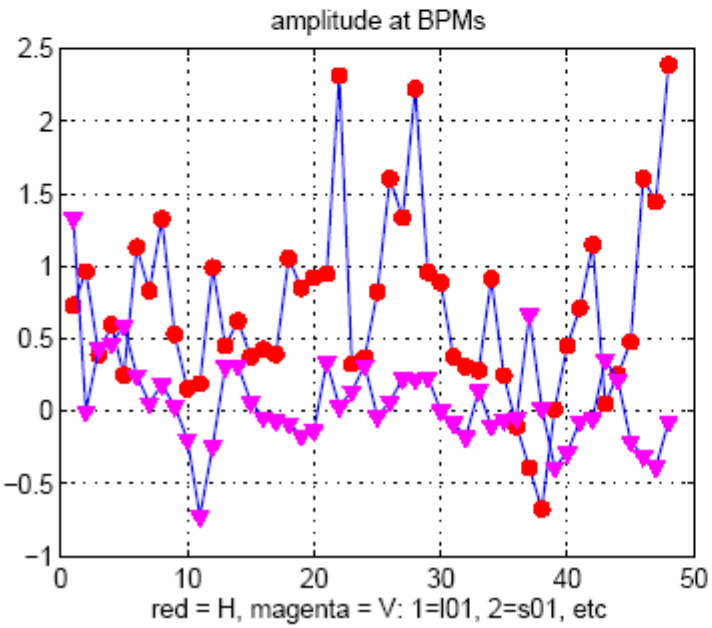

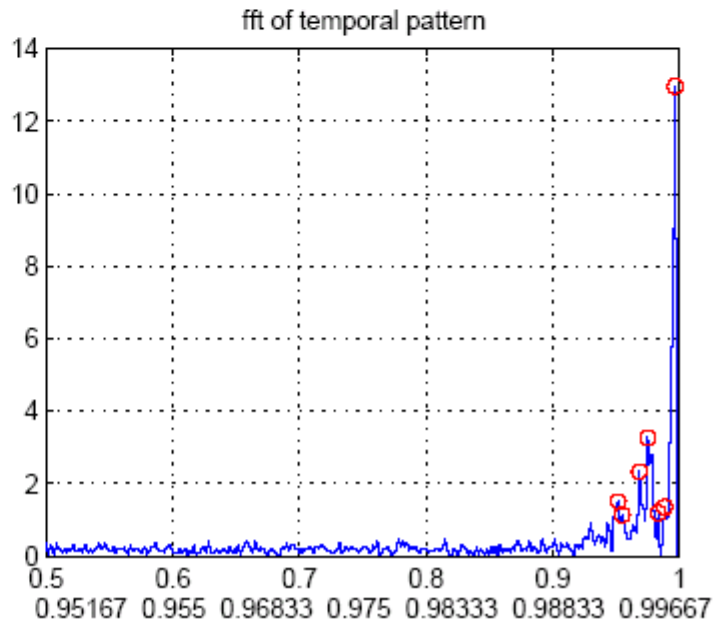

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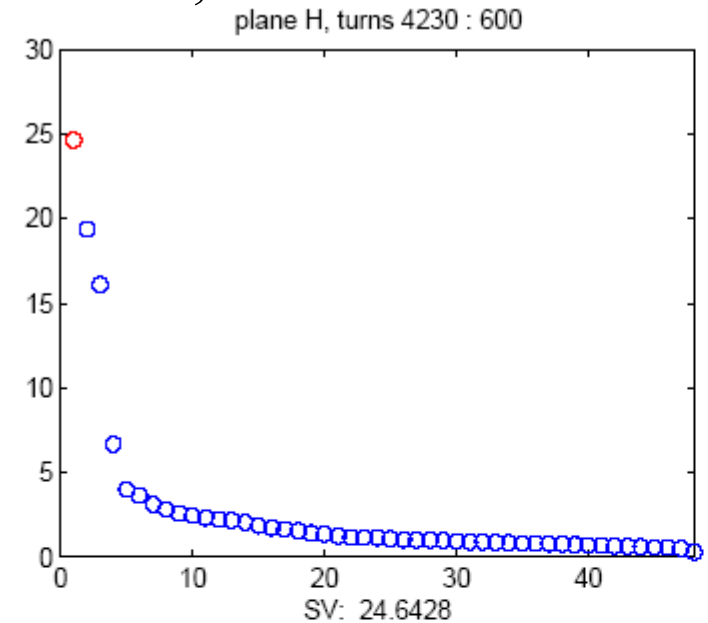
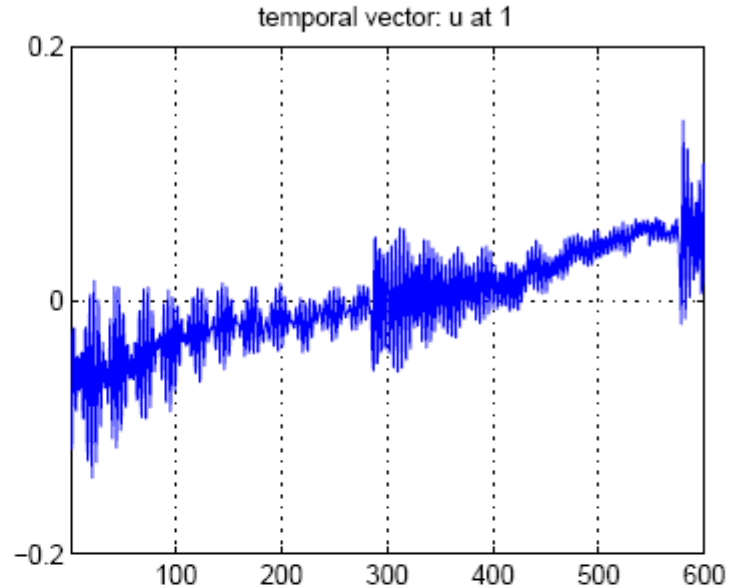
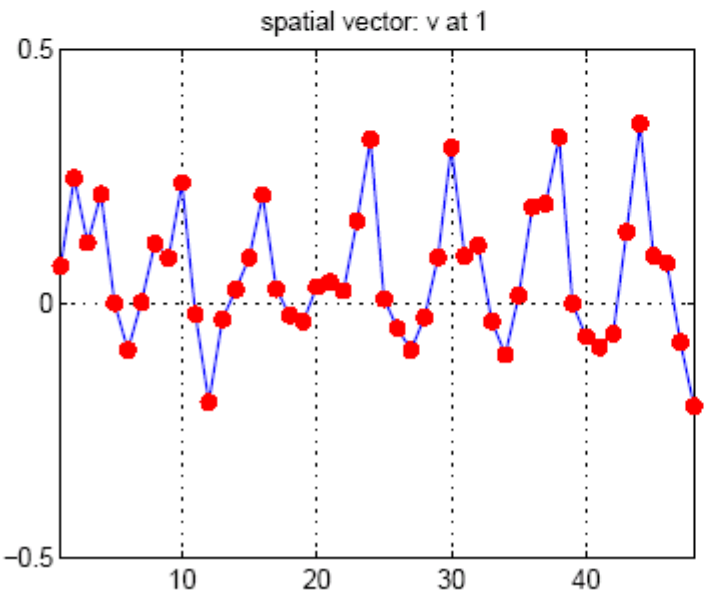
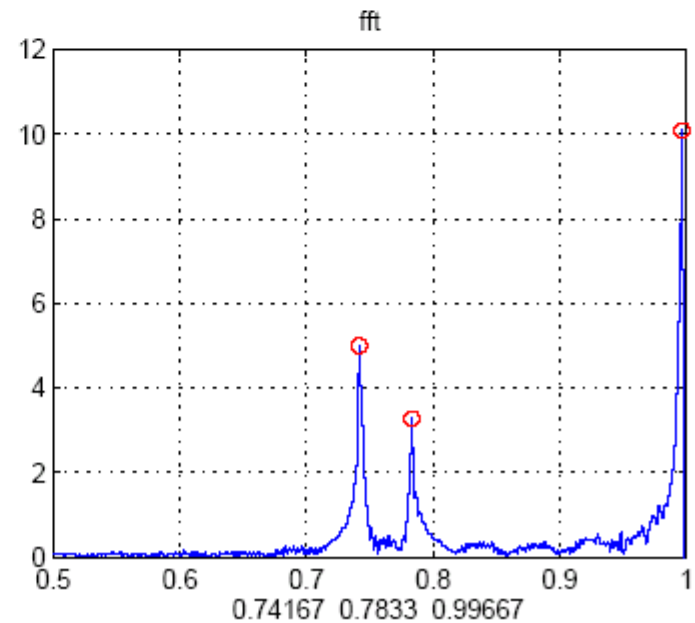
MIA Mode 1; before shutdown



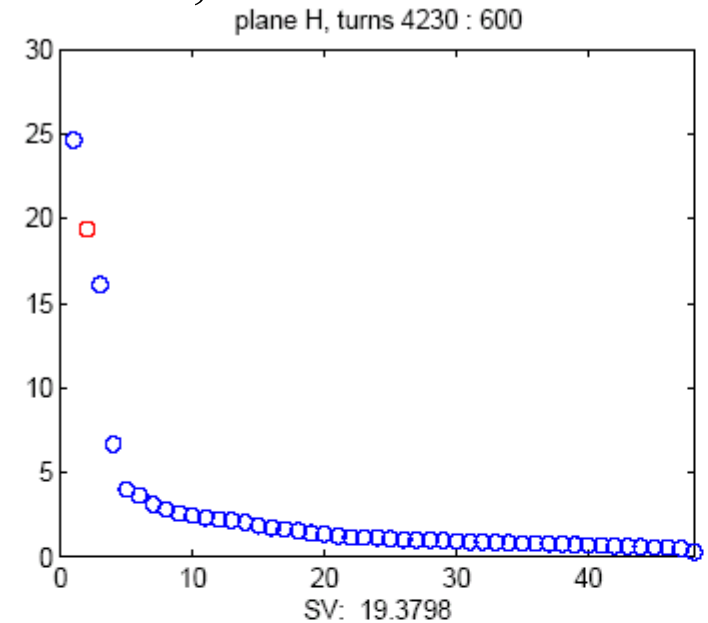


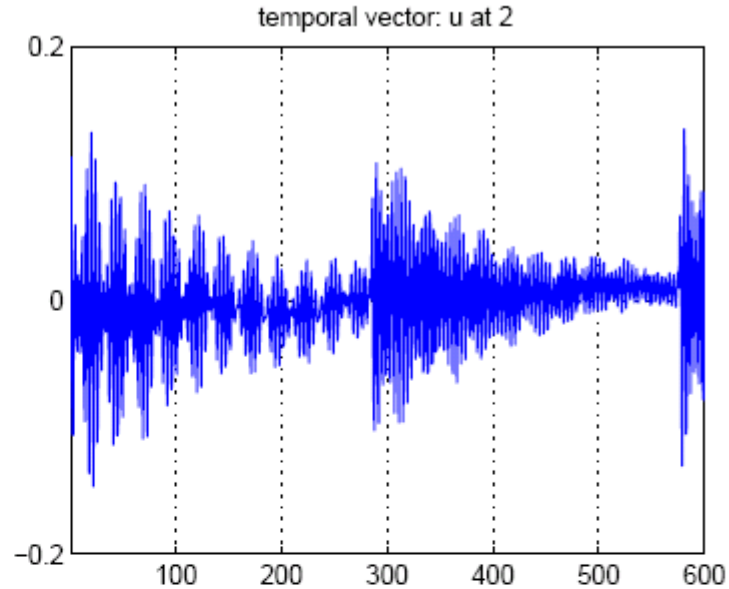


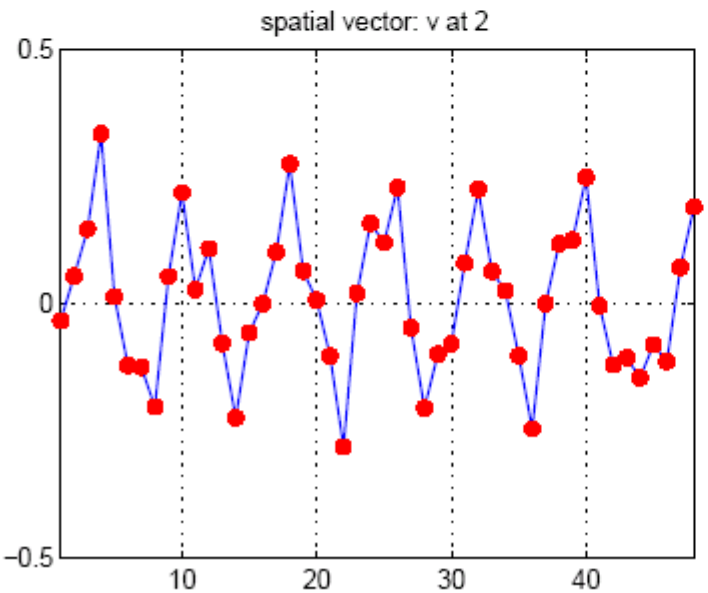


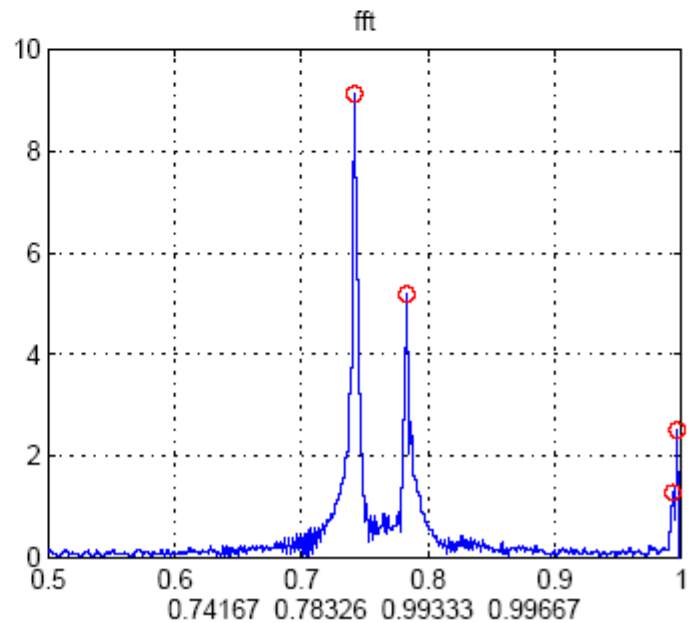
Student Version of MATLAB

MIA Mode 2; before shutdown

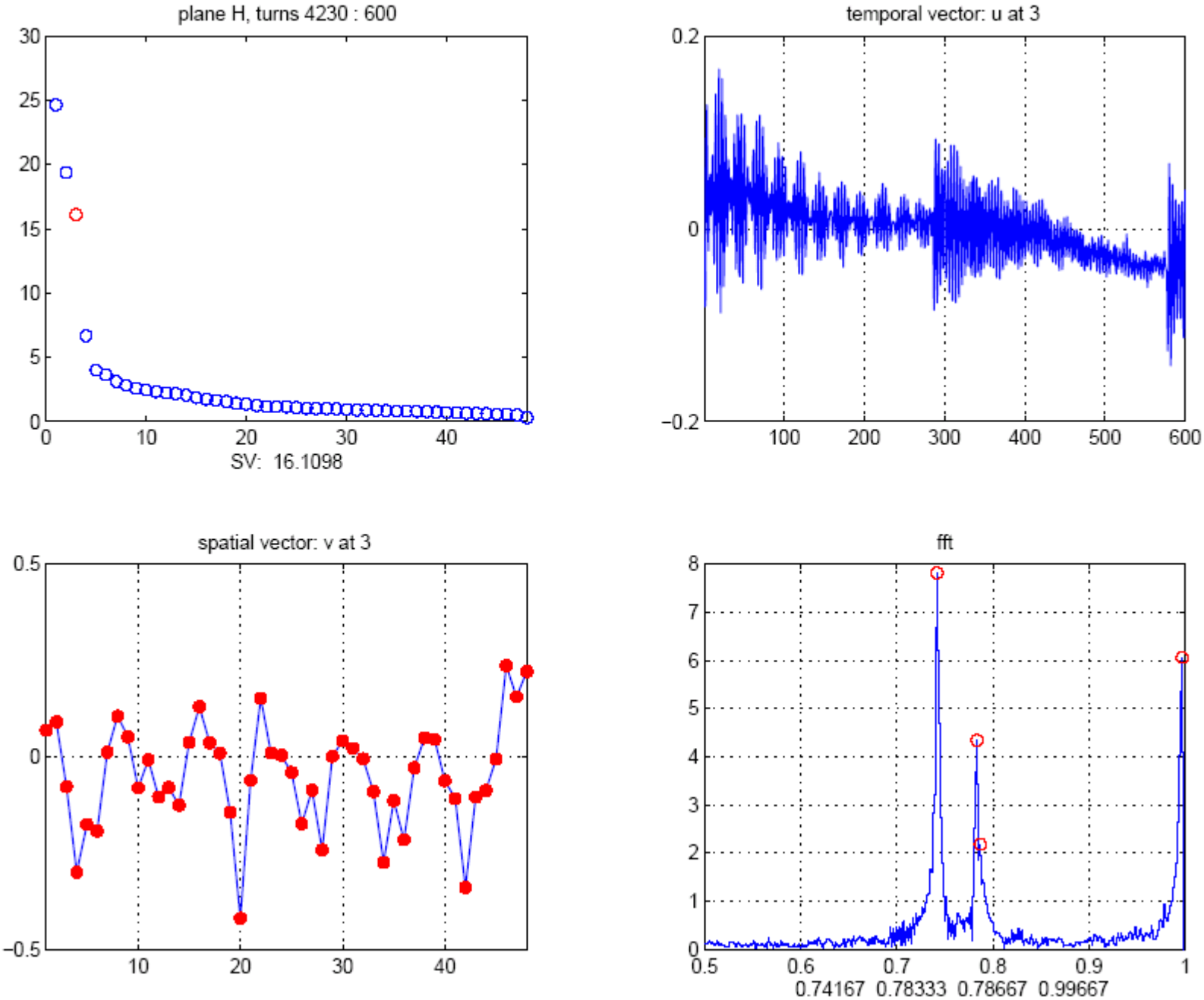


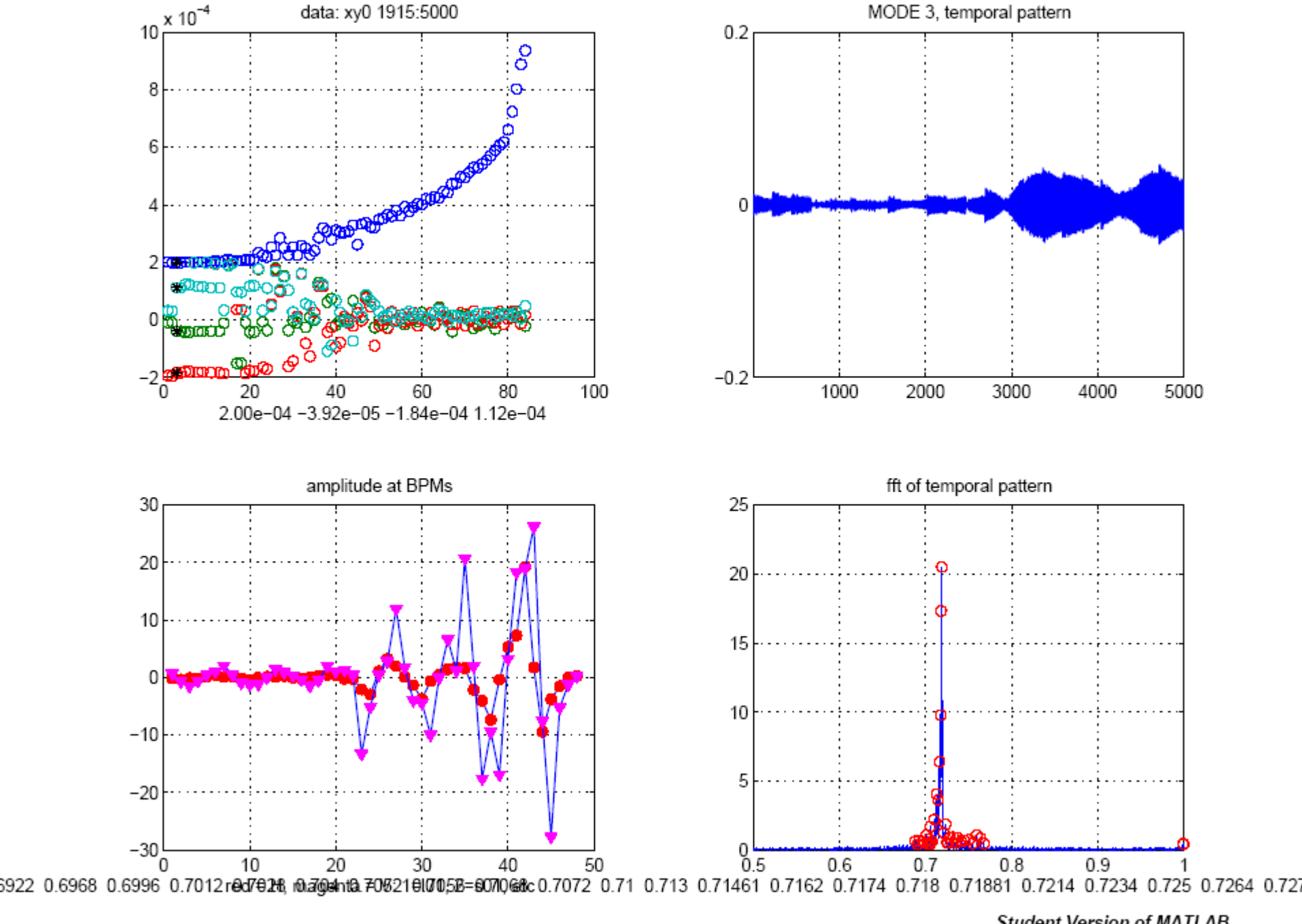


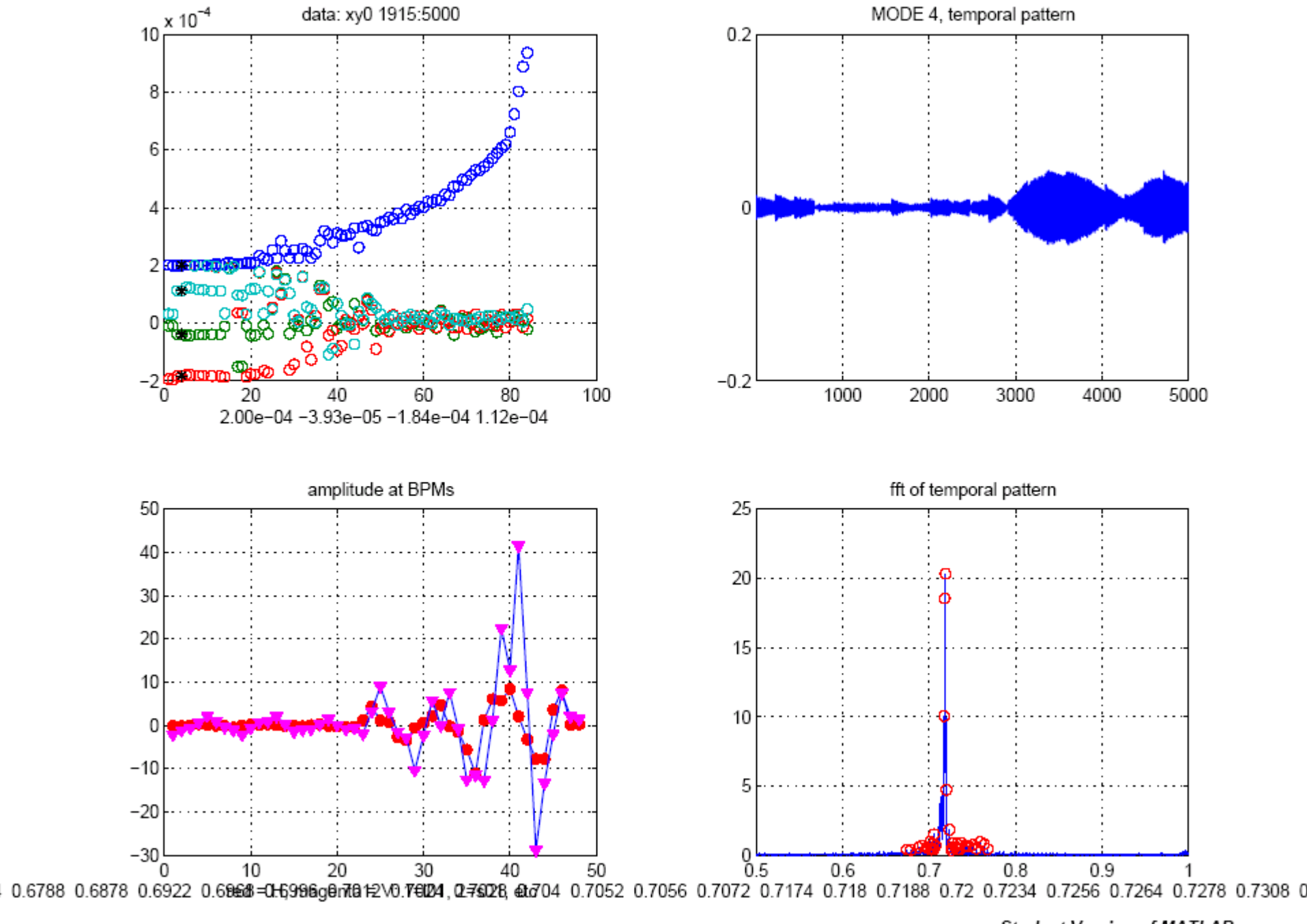


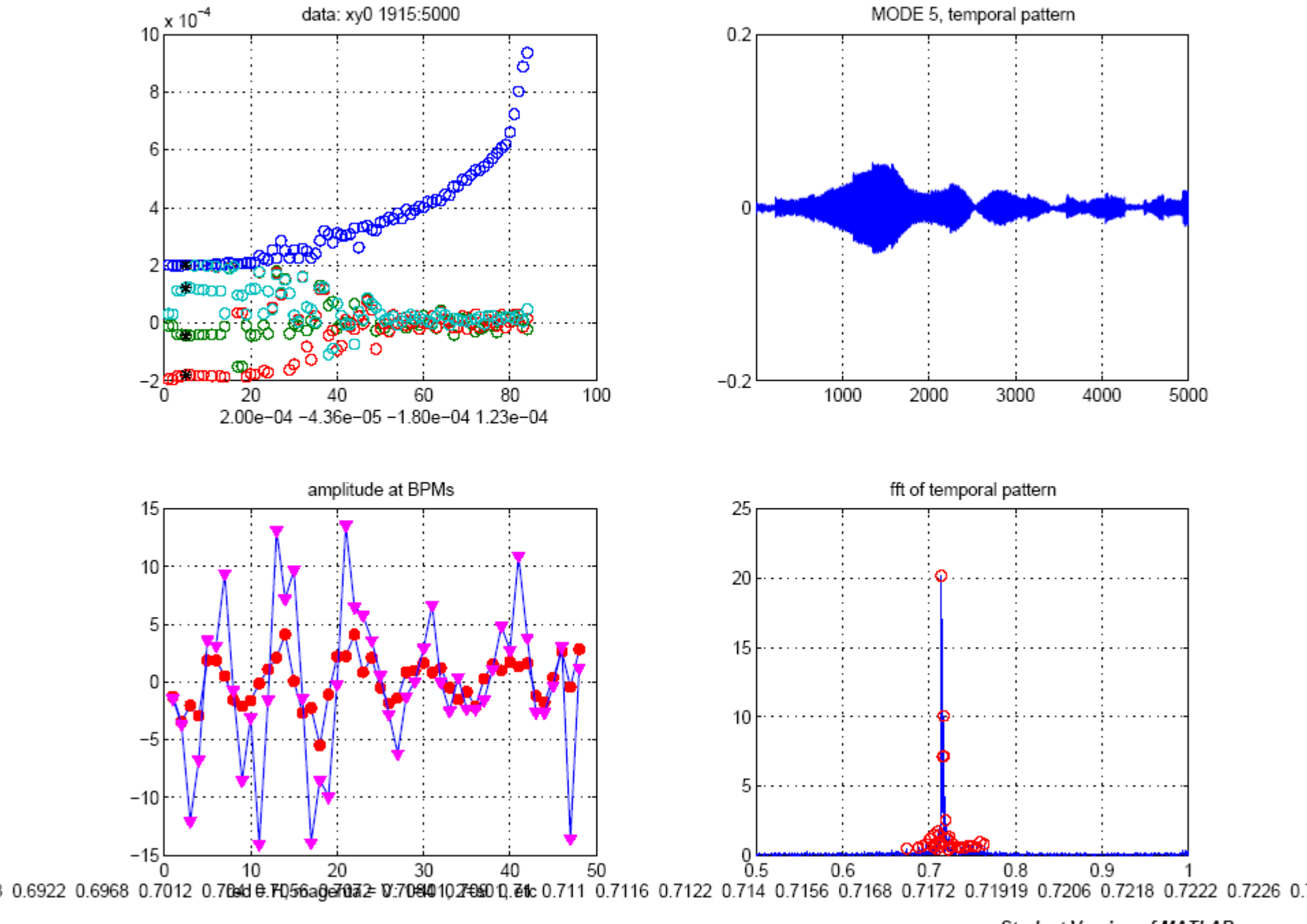


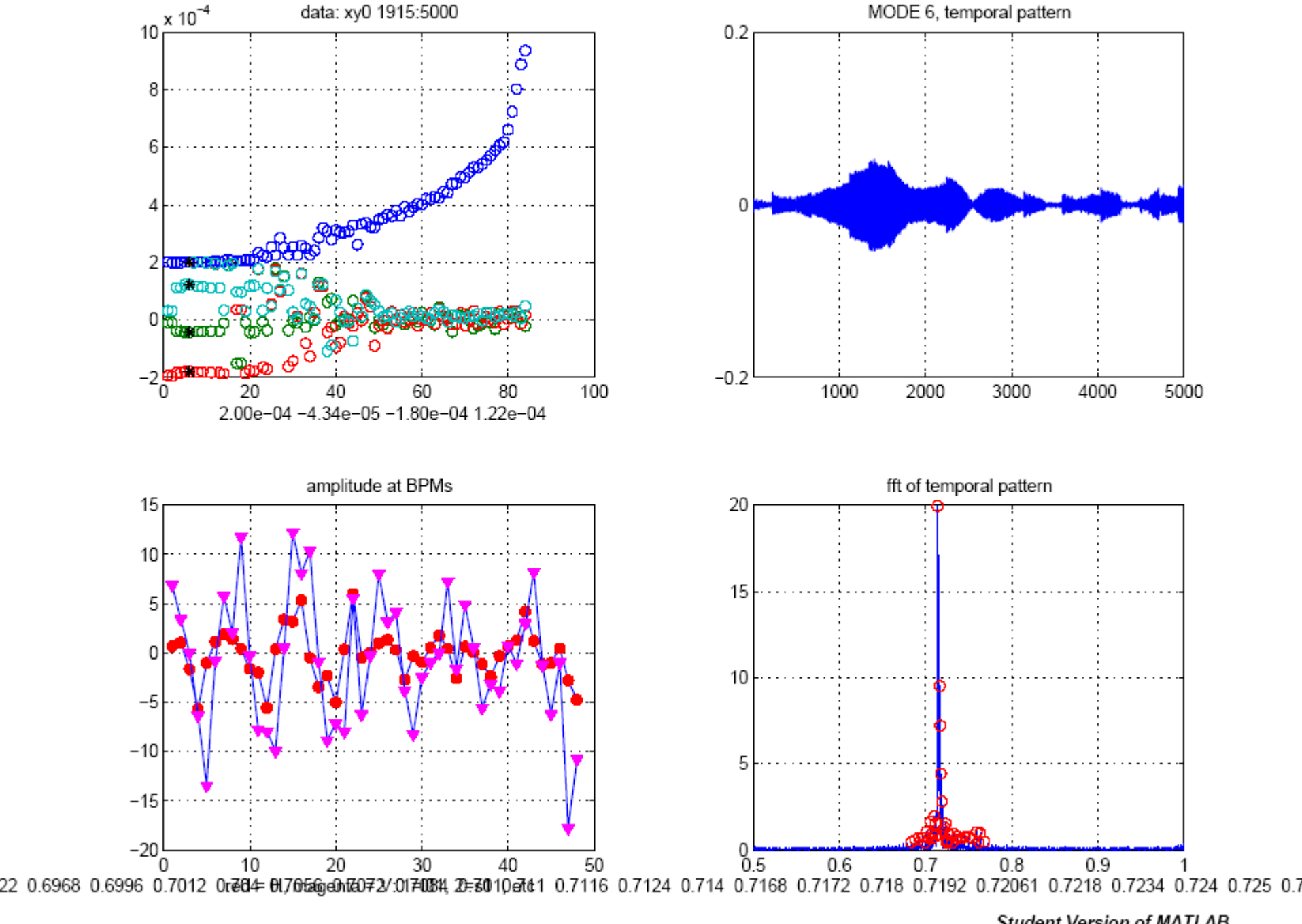
Student Version of MATLAB

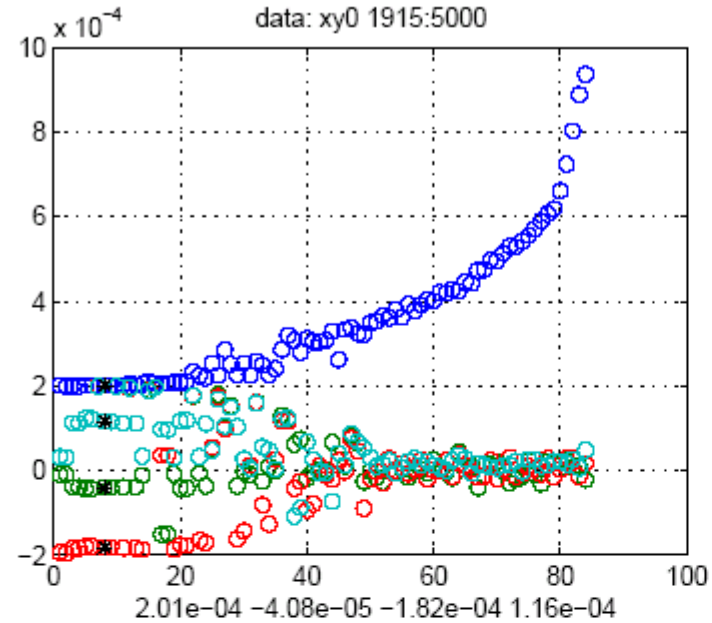

plane H, turns 4230 : 600
SV: 16.1098
temporal vector: u at 3
spatial vector: v at 3
fft
0.74167 0.78333 0.78667 0.99667
Student Version of MATLAB

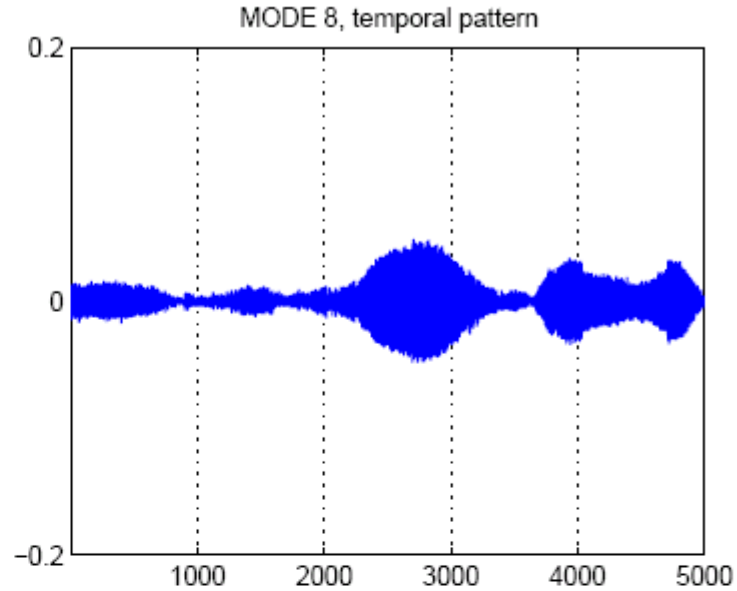

data: xy0 1915:5000
x 10^-4
2.00e−04 −3.92e−05 −1.84e−04 1.12e−04
MODE 3, temporal pattern
amplitude at BPMs
fft of temporal pattern
Student Version of MATLAB

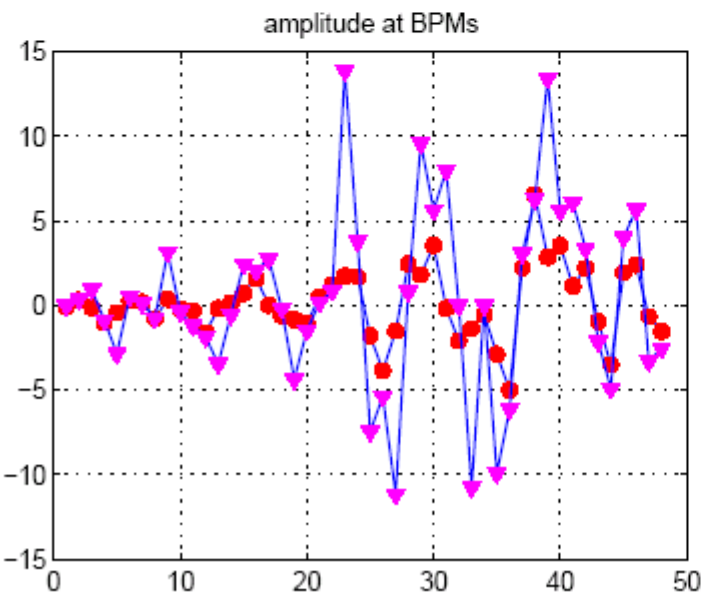

data: xy0 1915:5000
x 10^-4
2.00e-04 -3.93e-05 -1.84e-04 1.12e-04
MODE 4, temporal pattern
amplitude at BPMs
fft of temporal pattern
Student Version of MATLAB

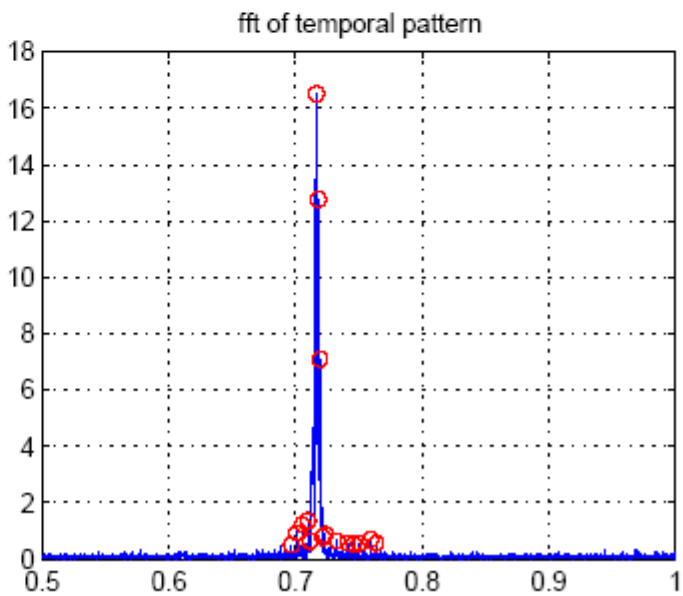

data: xy0 1915:5000
x 10^-4
2.00e-04 -4.36e-05 -1.80e-04 1.23e-04
MODE 5, temporal pattern
amplitude at BPMs
fft of temporal pattern
Student Version of MATLAB


data: xy0 1915:5000
x 10^-4
2.00e-04 -4.34e-05 -1.80e-04 1.22e-04
MODE 6, temporal pattern
amplitude at BPMs
fft of temporal pattern
Student Version of MATLAB









red = H, magenta = V: 1=I01, 2=I03, etc 0.7012 0.7056 0.71 0.7114 0.7122 0.7166 0.7182 0.71941 0.7218 0.7234 0.7324 0.7414 0.745

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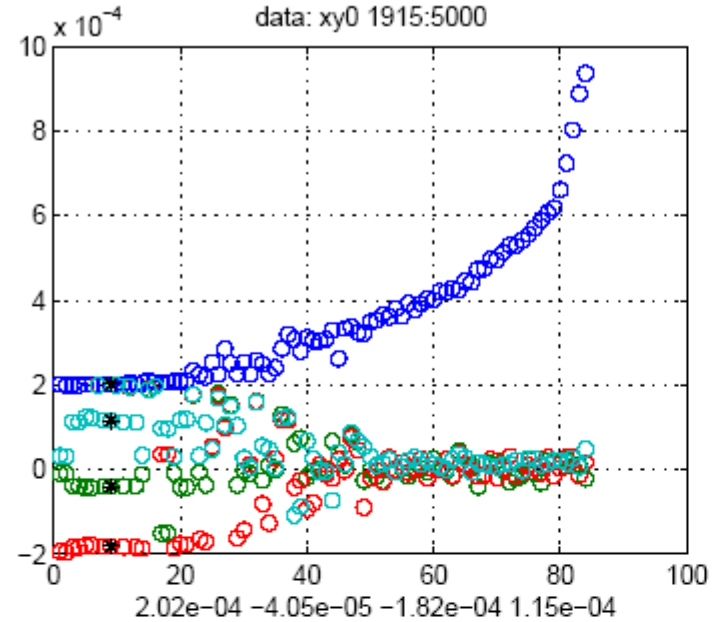
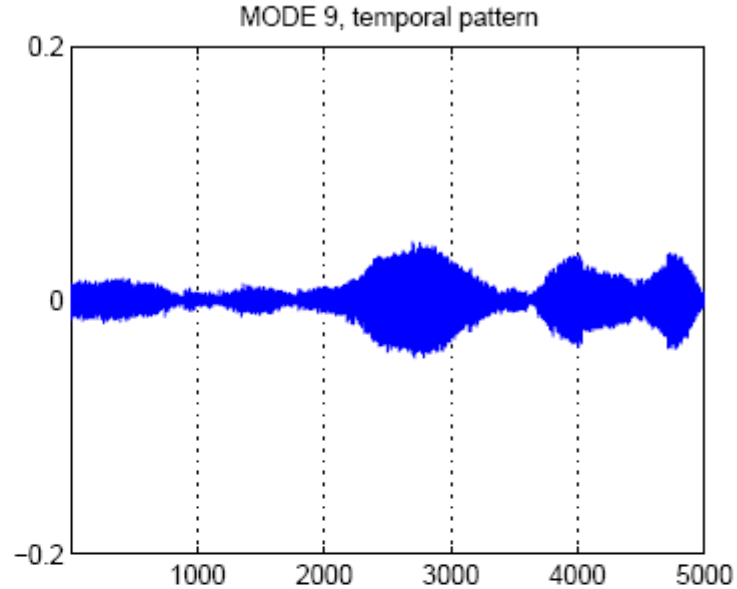
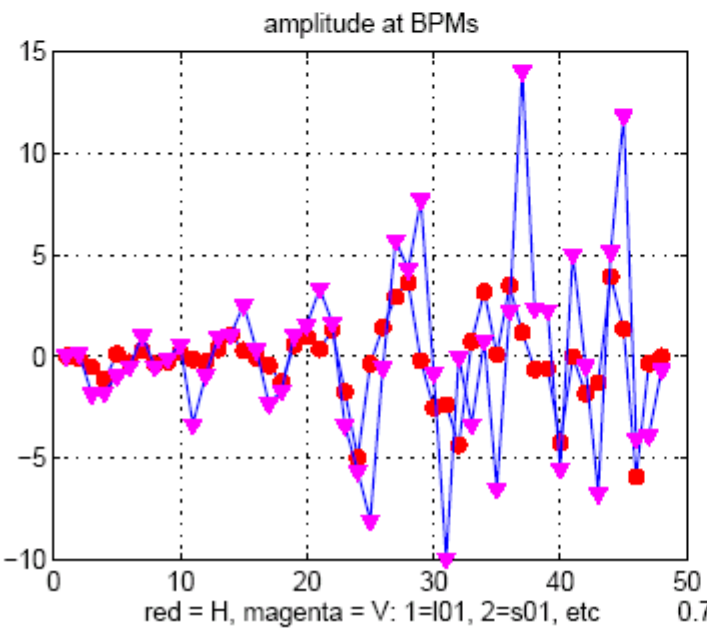
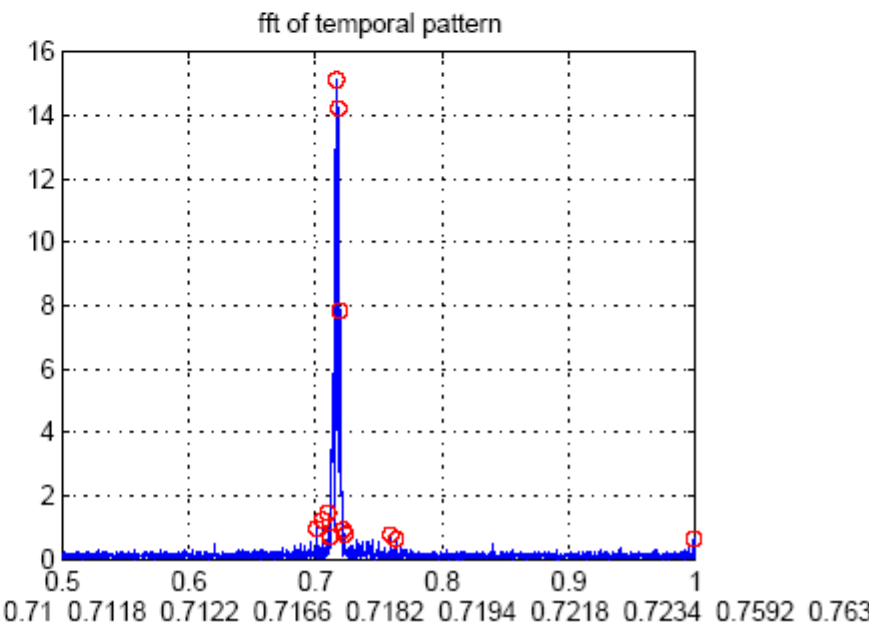
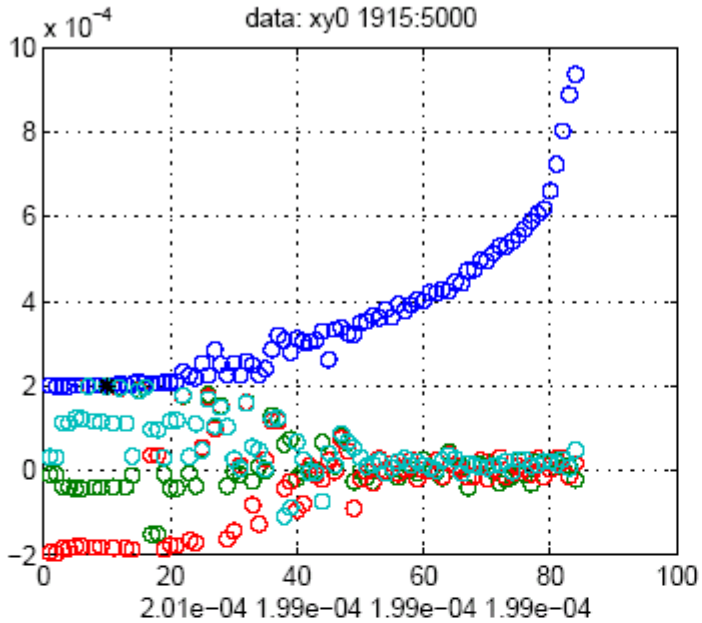


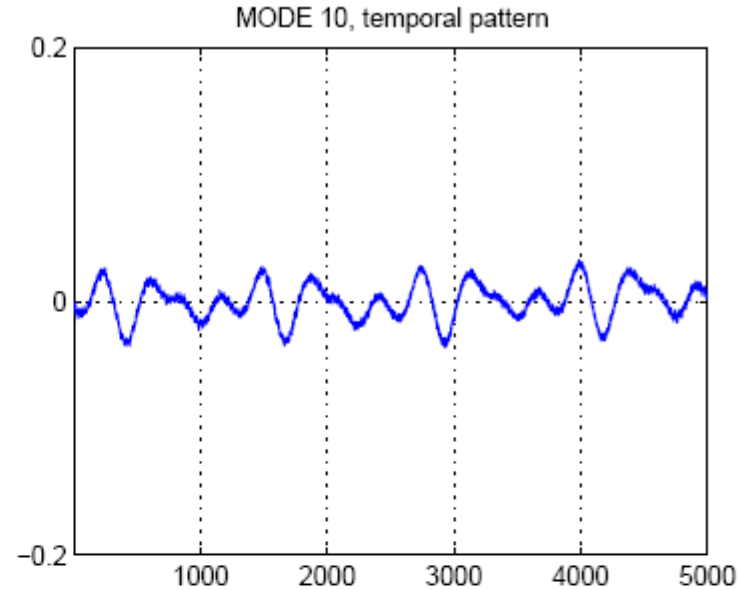


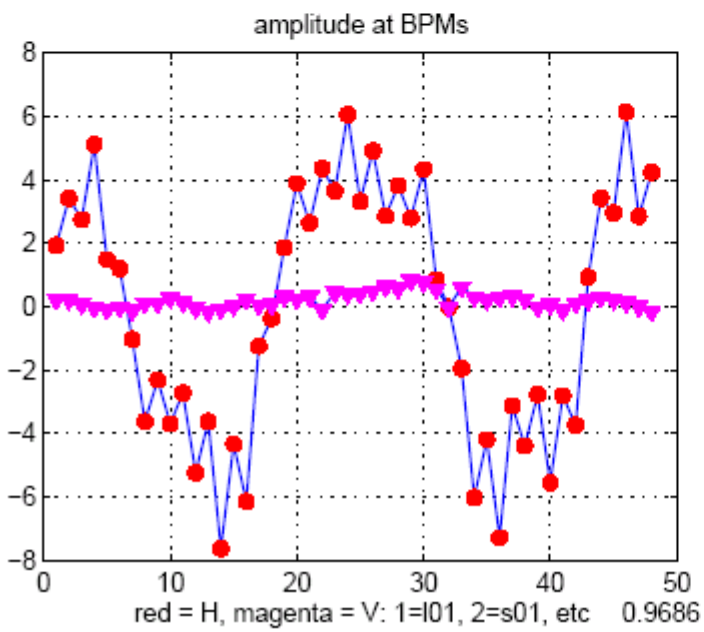


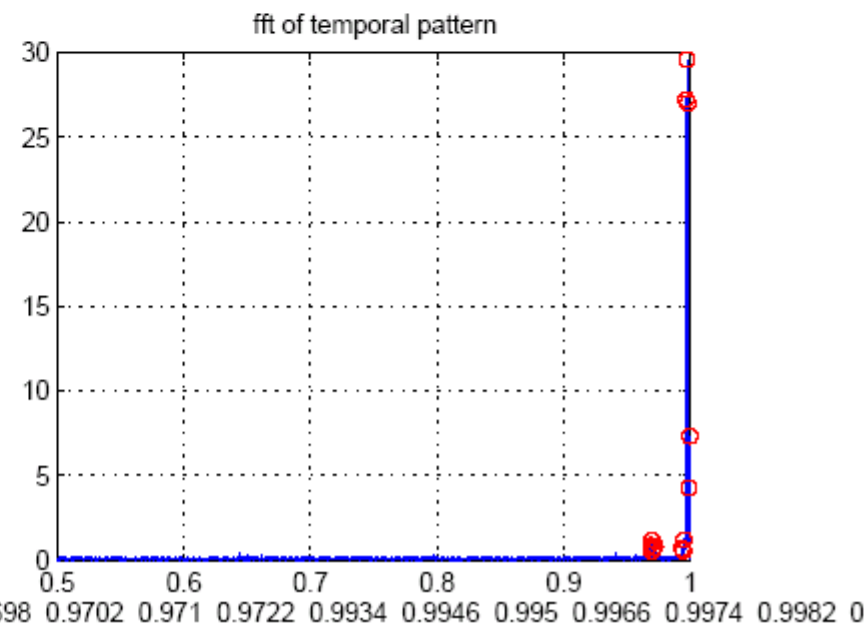


Student Version of MATLAB

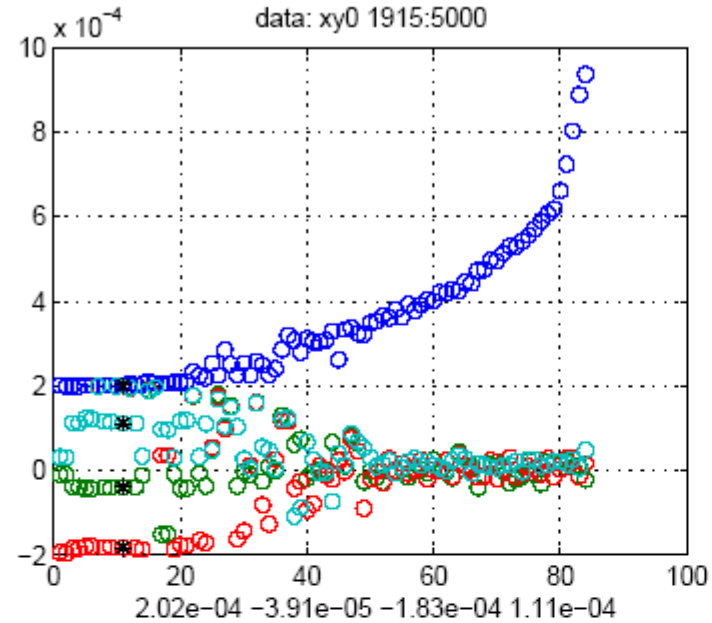


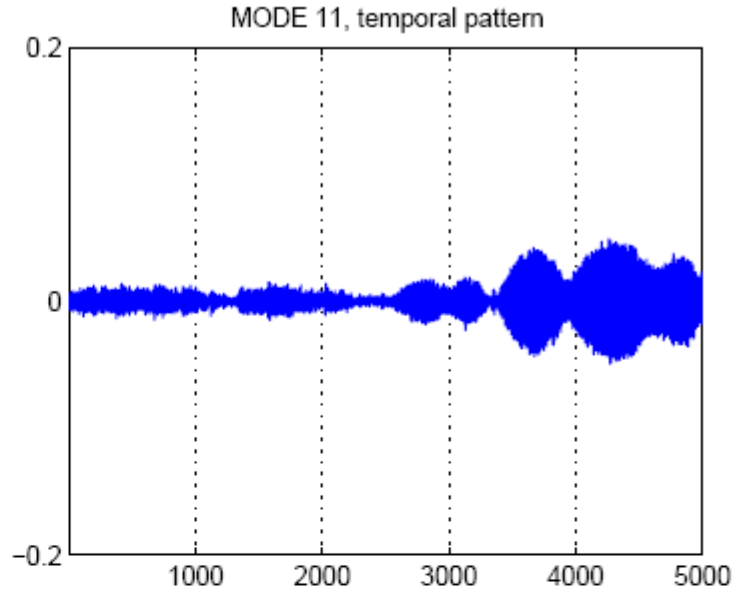


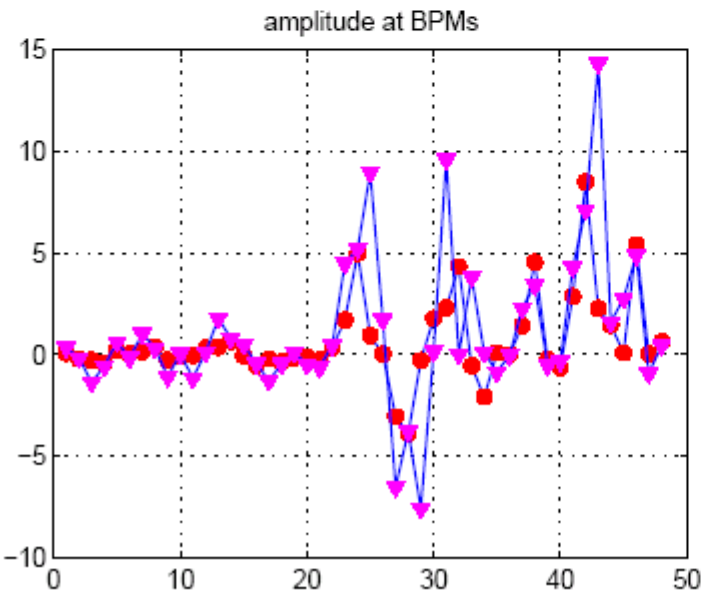


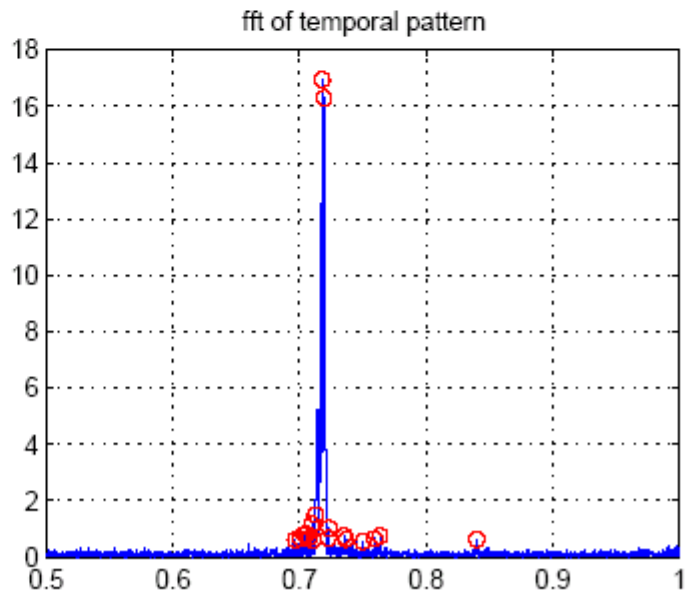


Student Version of MATLAB









red = H, magenta = V: 1=I01, 2=I08, etc. 0.7012 0.704 0.7056 0.7084 0.71 0.711 0.7126 0.718 0.7194 0.723 0.7234 0.7352 0.7368 0.7

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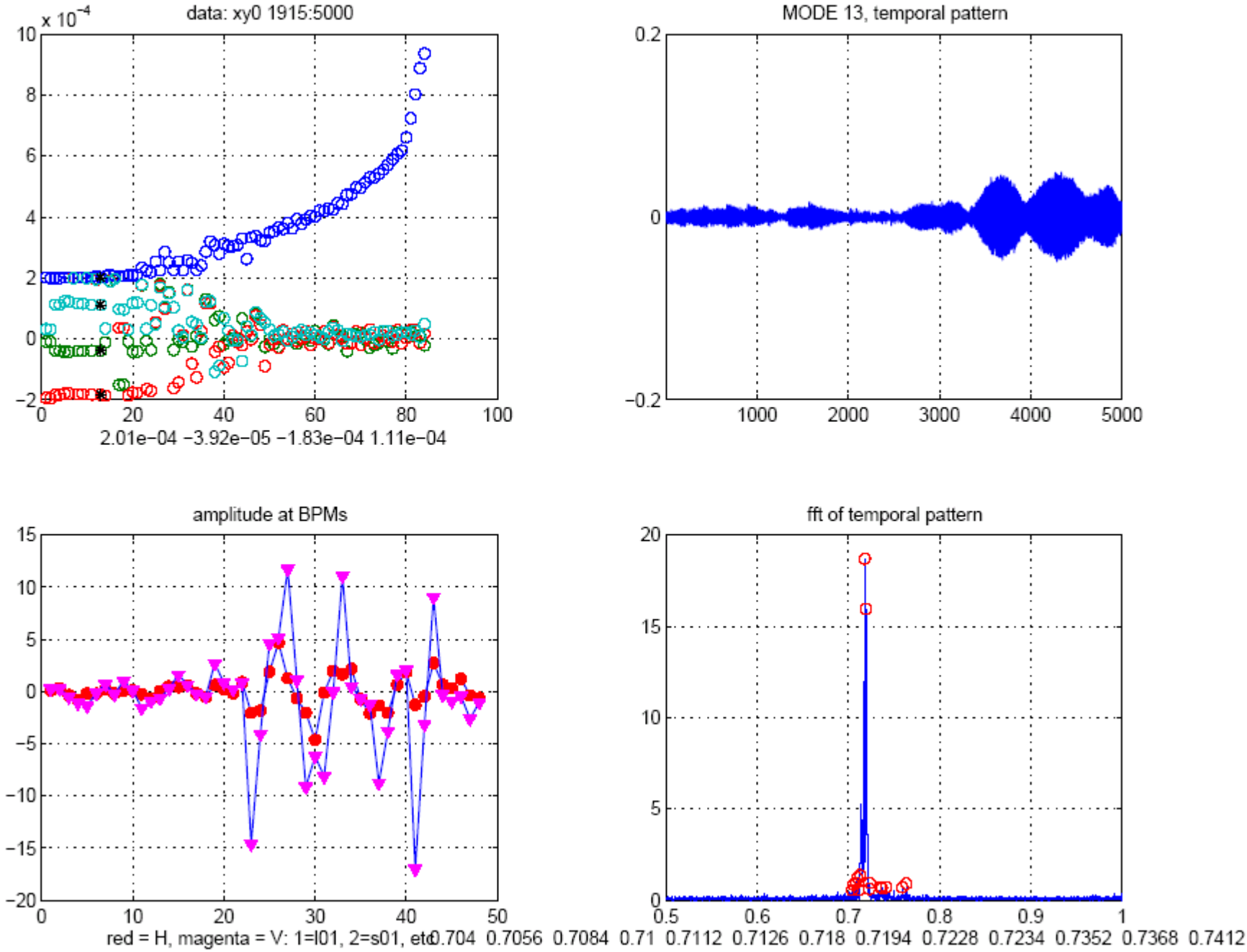
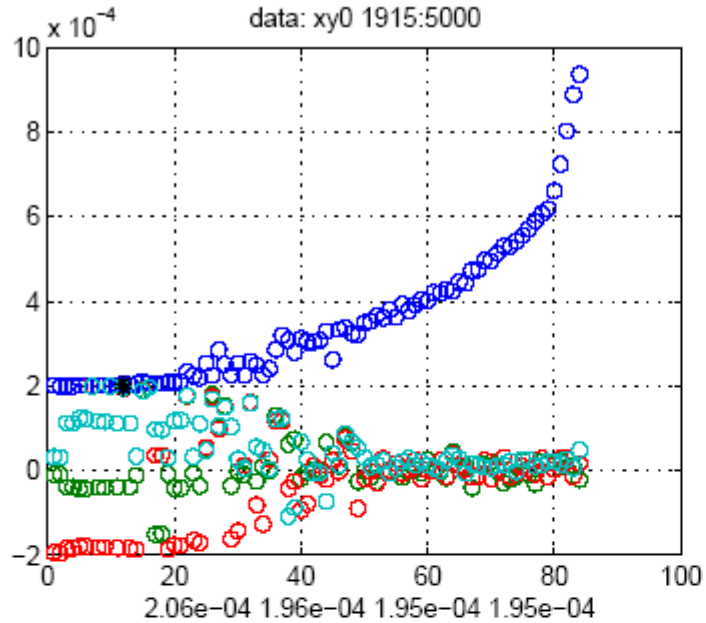
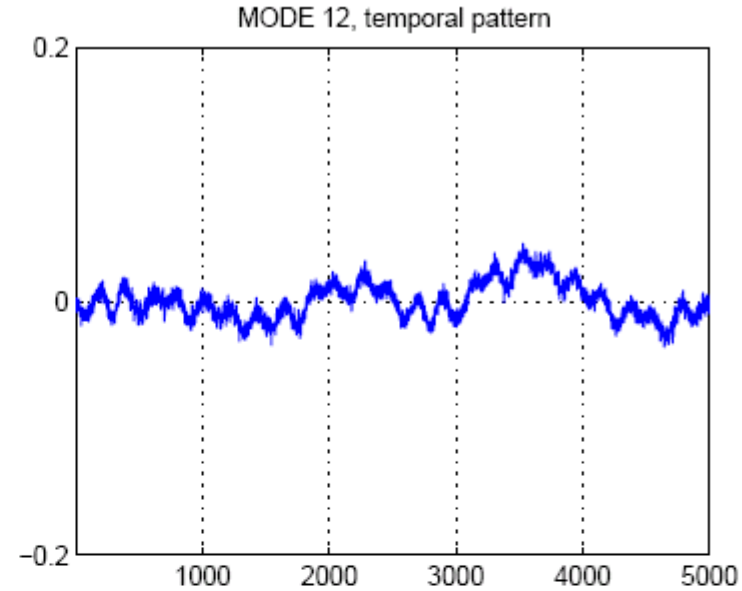
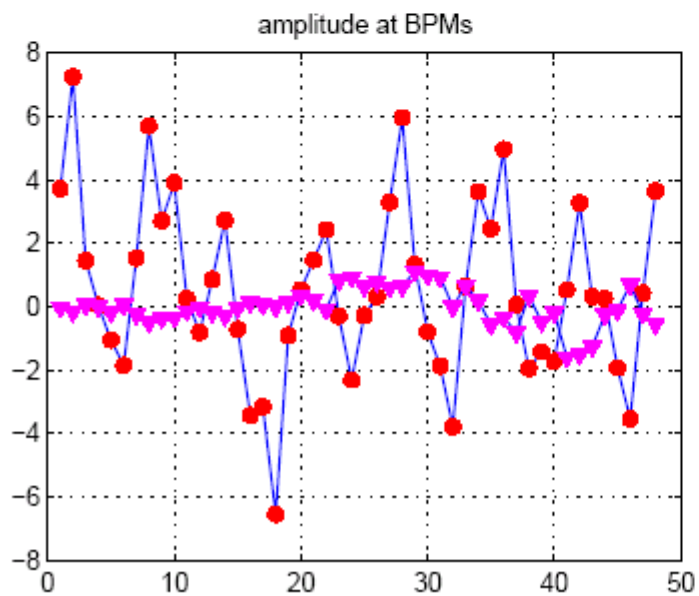
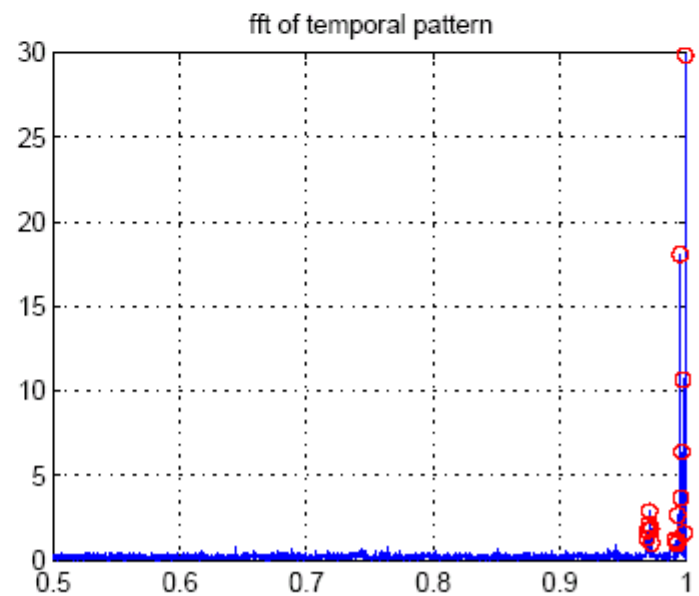

data: xy0 1915:5000
x 10^-4
2.01e−04 −3.92e−05 −1.83e−04 1.11e−04
MODE 13, temporal pattern
amplitude at BPMs
red = H, magenta = V: 1=l01, 2=s01, etc
fft of temporal pattern
0.704 0.7056 0.7084 0.71 0.7112 0.7126 0.718 0.7194 0.7228 0.7234 0.7352 0.7368 0.7412
Student Version of MATLAB



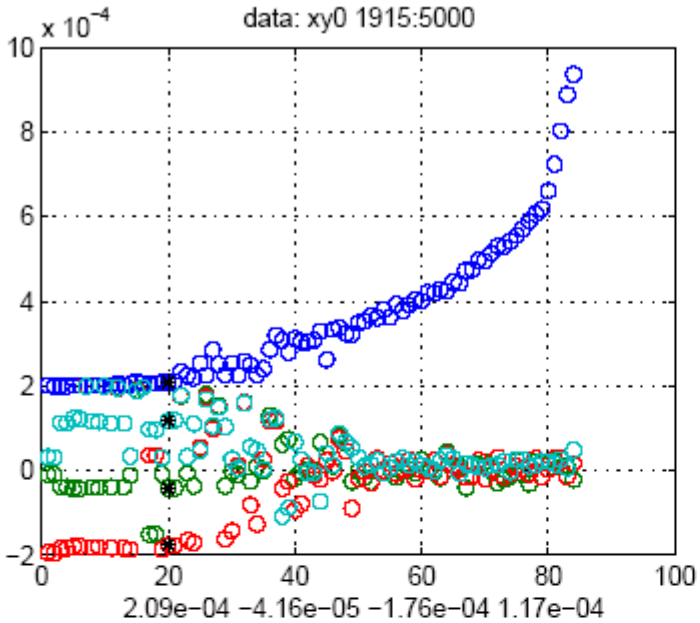


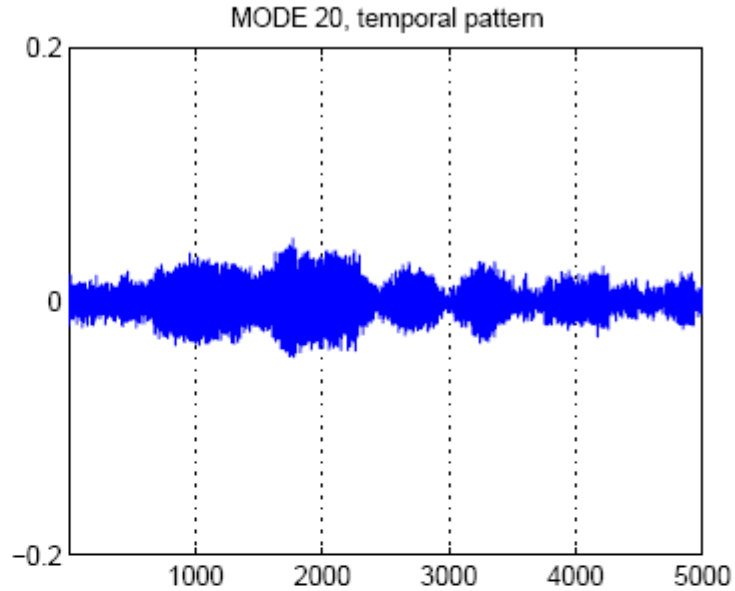


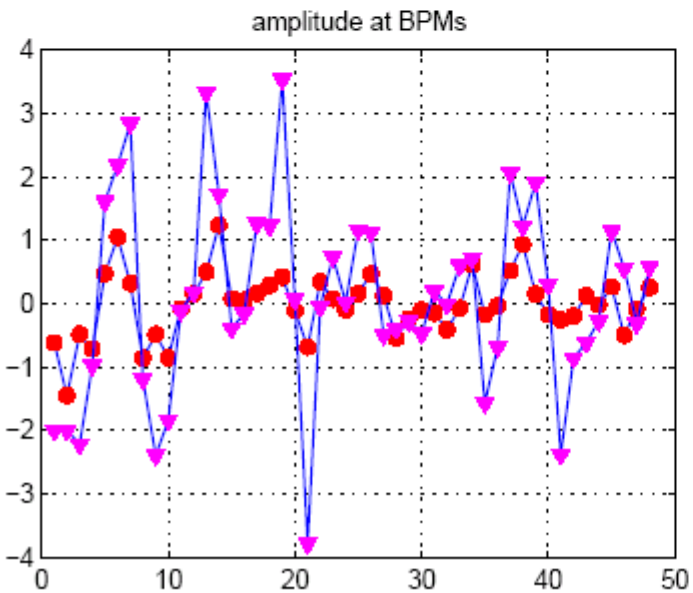


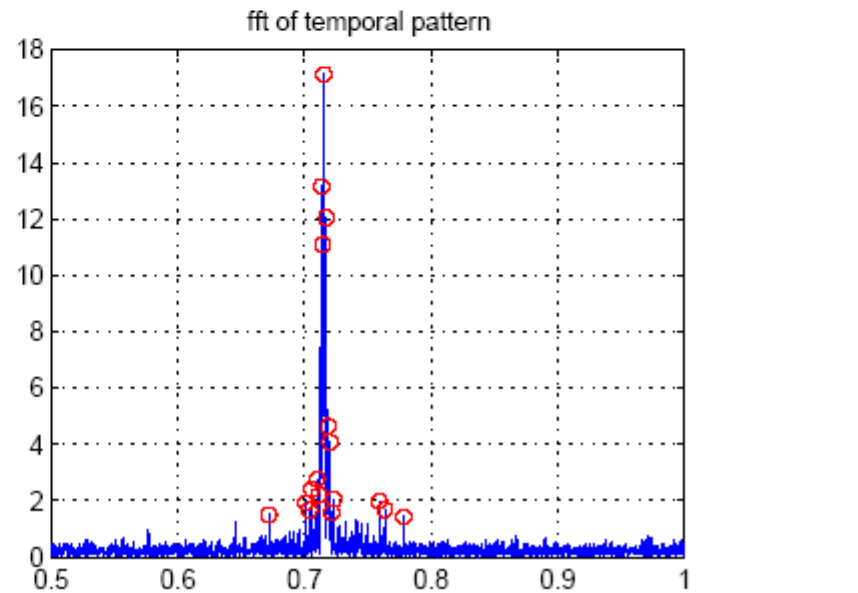
red = H, magenta = V: 1=I01, 2=s01, etc 0.96939 0.9706 0.971 0.9722 0.9726 0.9914 0.9926 0.993 0.9934 0.995 0.9958 0.9966 0.

Student Version of MATLAB



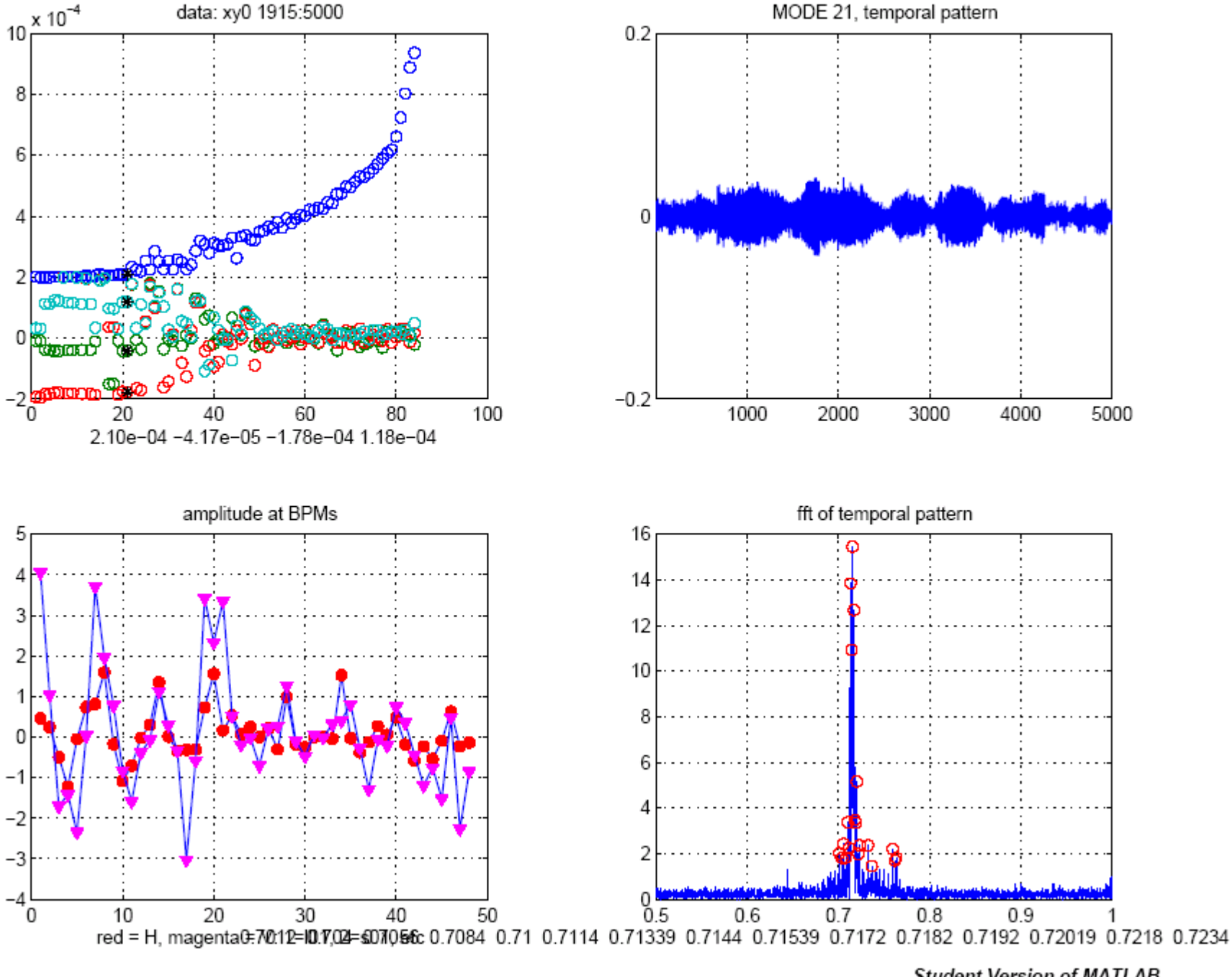




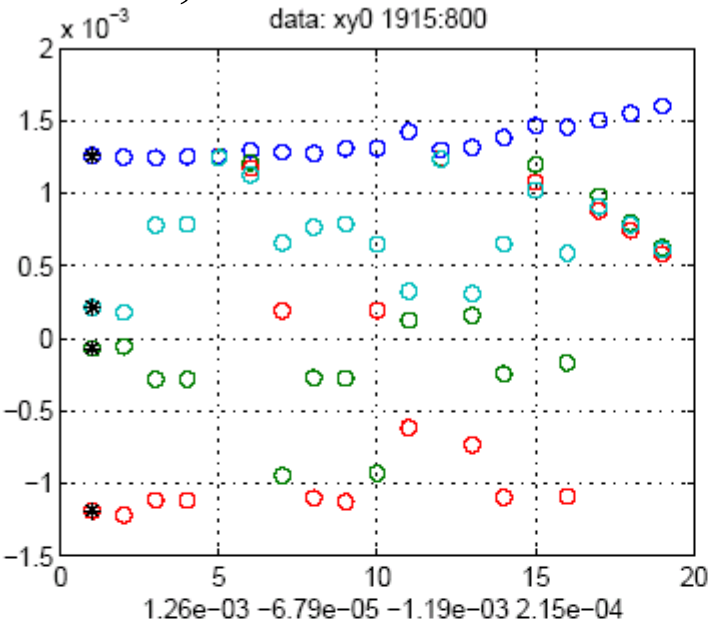


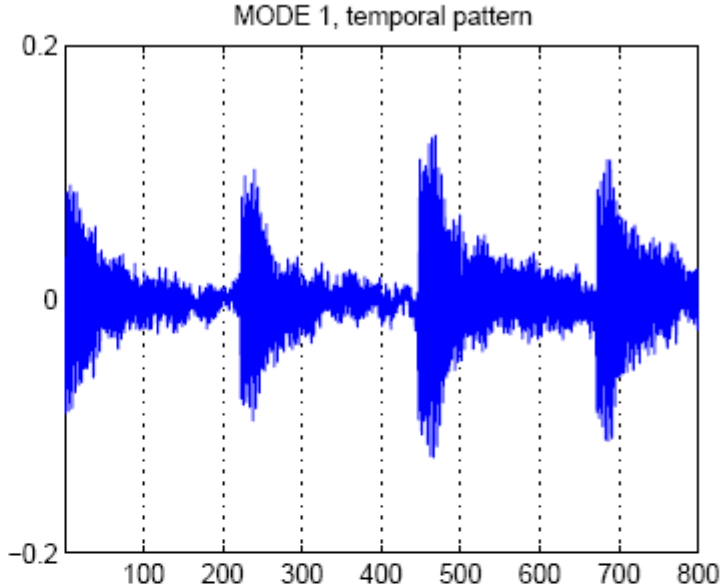
red = H, magenta = V: 1=I01, 2=I02, etc. 0.7012 0.704 0.7056 0.71 0.7114 0.7134 0.7144 0.71539 0.71738 0.719 0.7202 0.7218 0.723

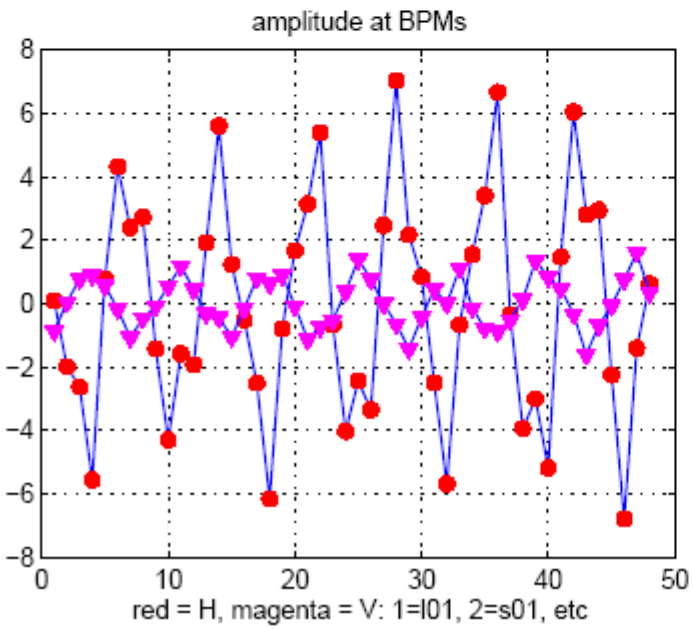
Student Version of MATLAB

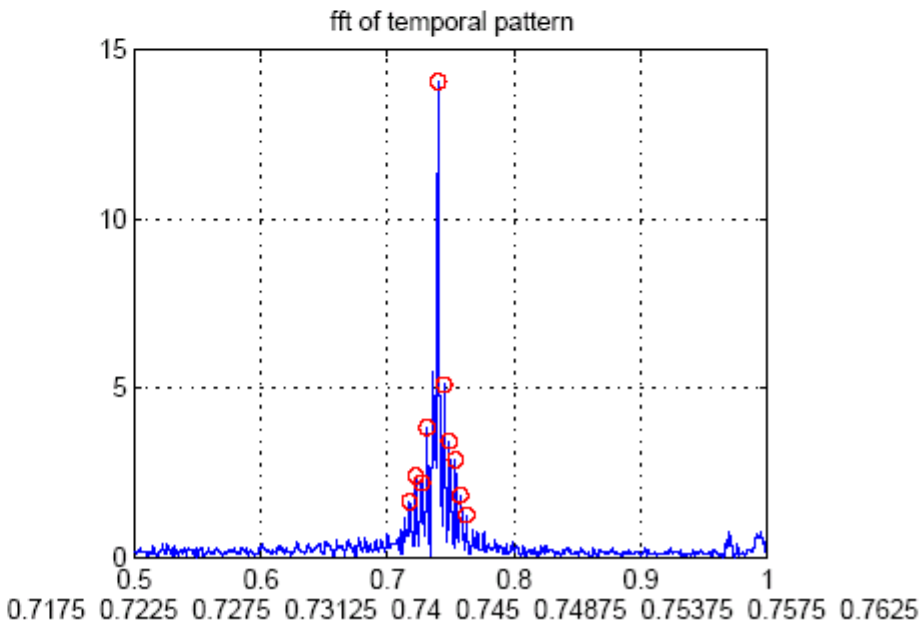

data: xy0 1915:5000
x 10^-4
2.10e−04 −4.17e−05 −1.78e−04 1.18e−04
MODE 21, temporal pattern
amplitude at BPMs
fft of temporal pattern
red = H, magenta = V
0.7012 0.7024 0.7056 0.7084 0.71 0.7114 0.71339 0.7144 0.71539 0.7172 0.7182 0.7192 0.72019 0.7218 0.7234
Student Version of MATLAB

ICA Mode 1; tbt99581- 1915:800



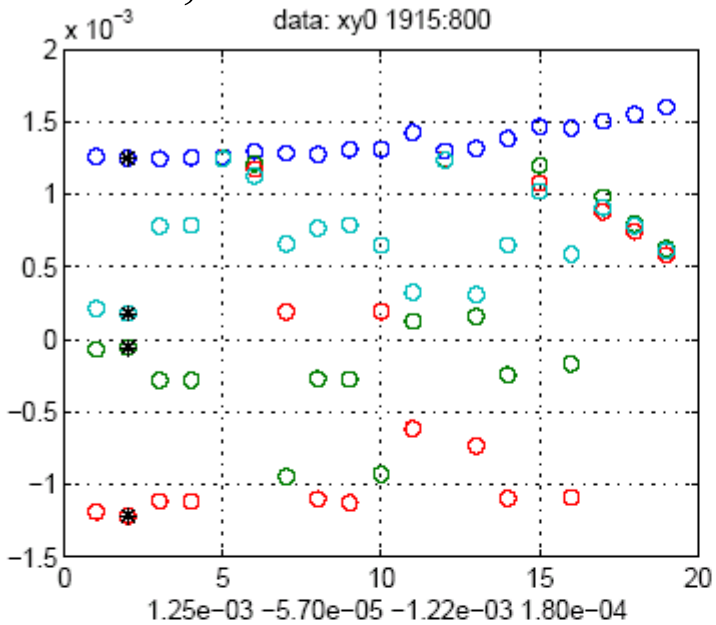


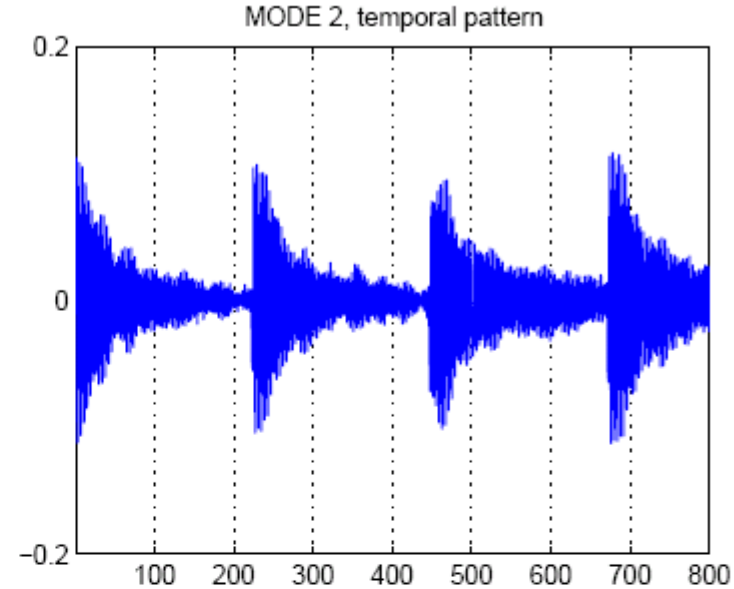


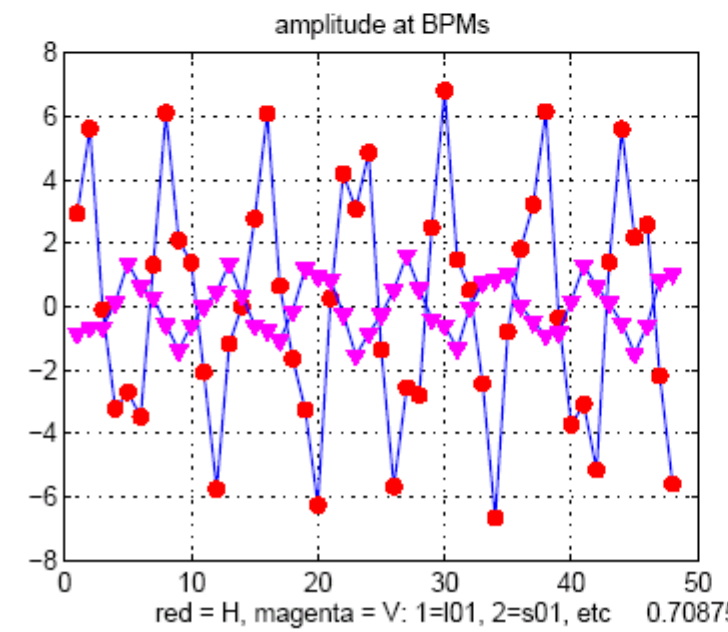


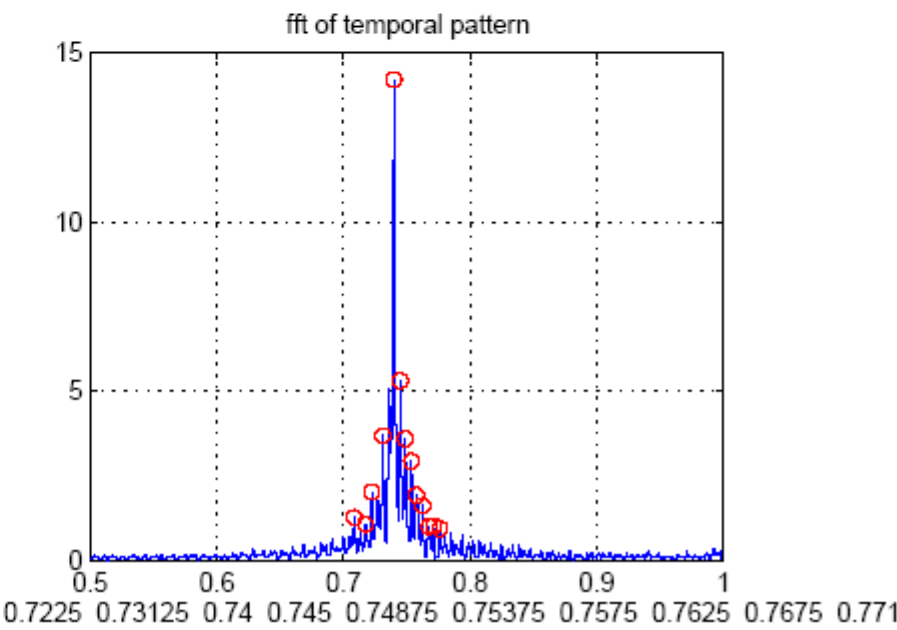
Student Version of MATLAB

ICA Mode 2; tbt99581- 1915:800



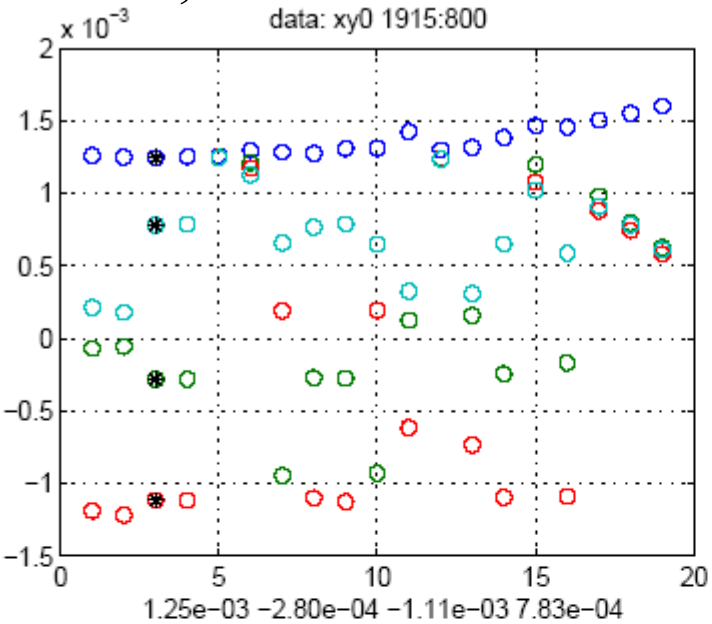


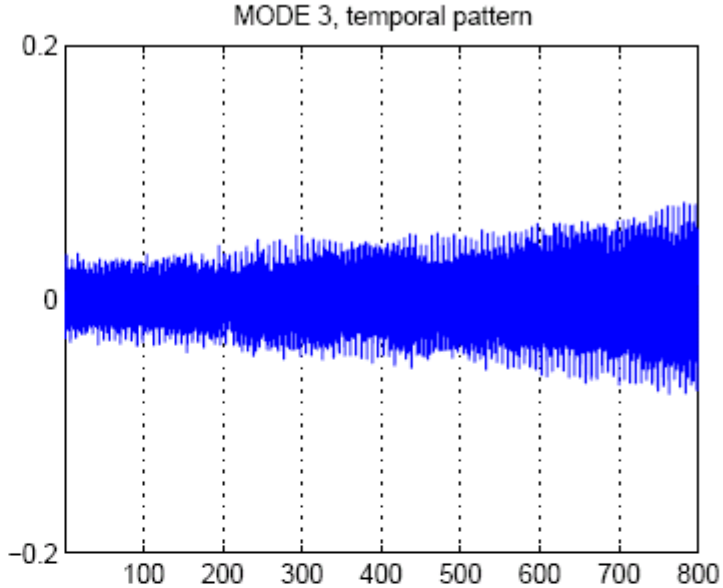


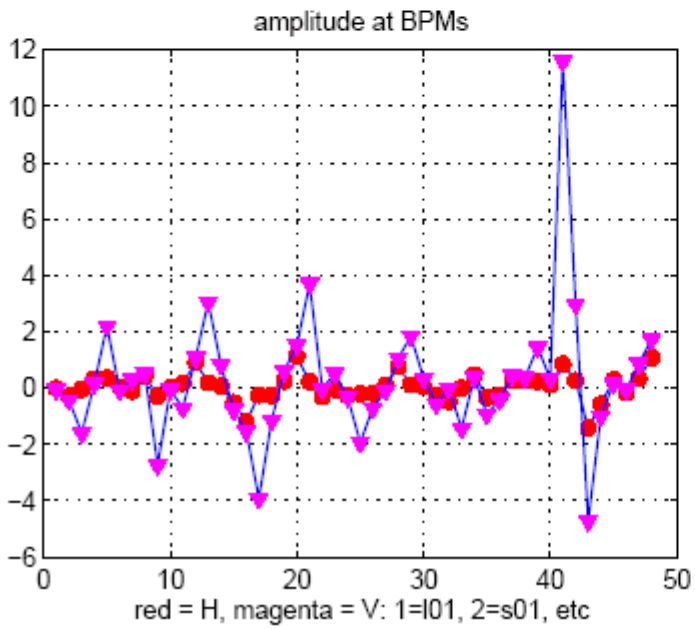


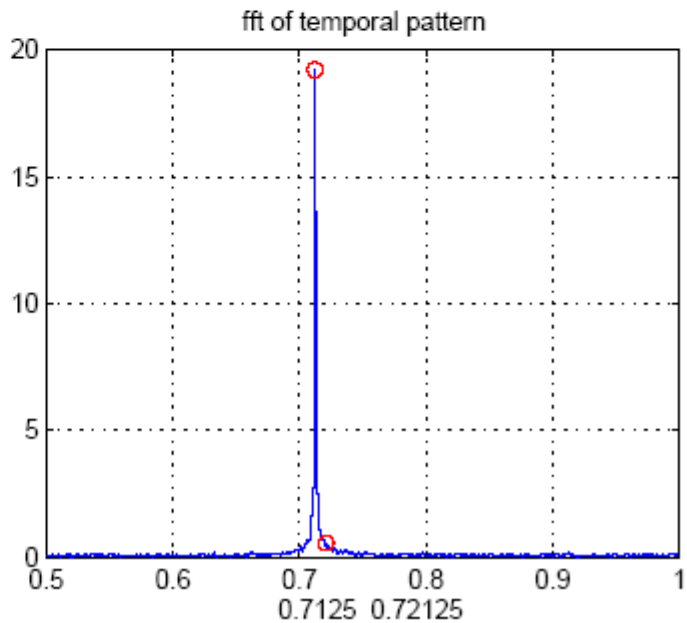
Student Version of MATLAB

ICA Mode 3; tbt99581- 1915:800



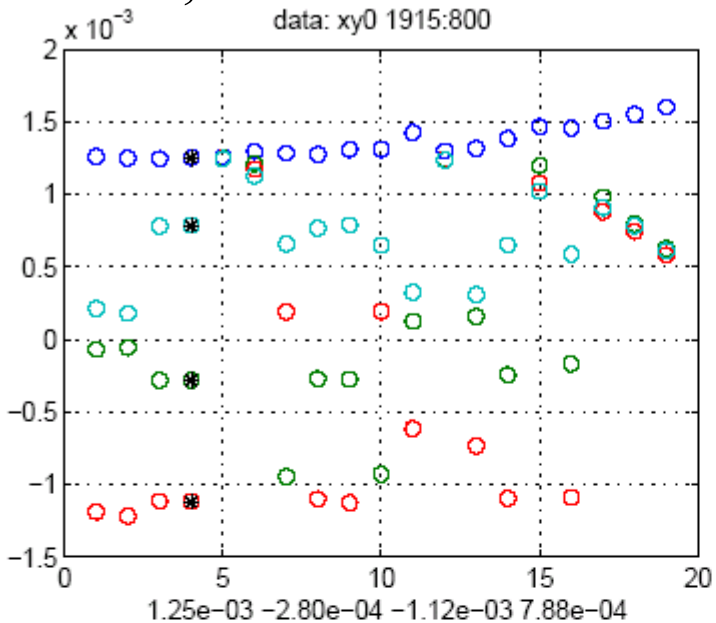


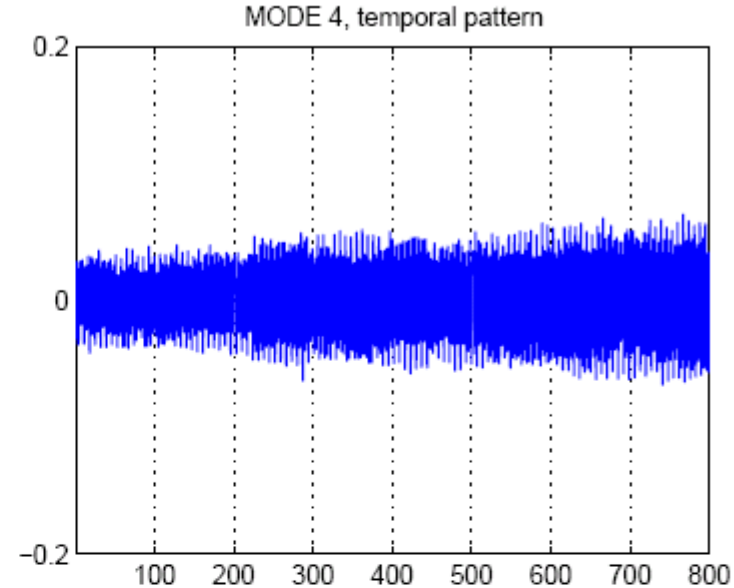


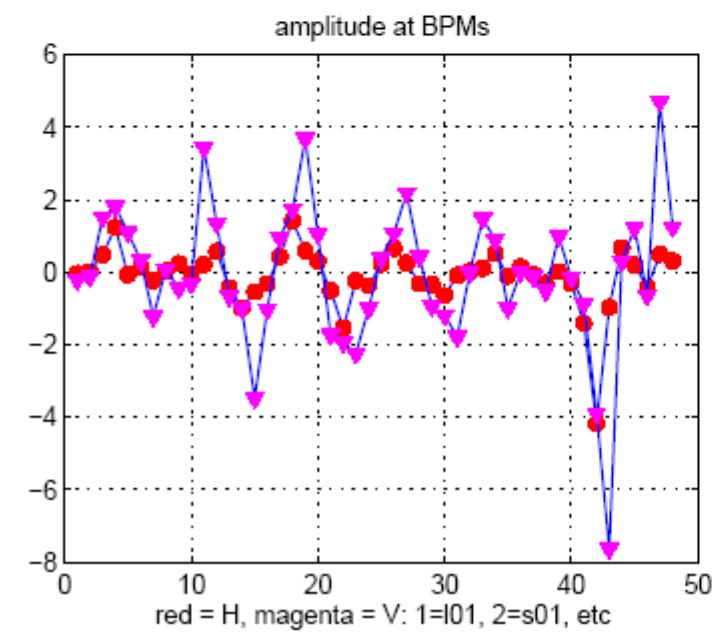


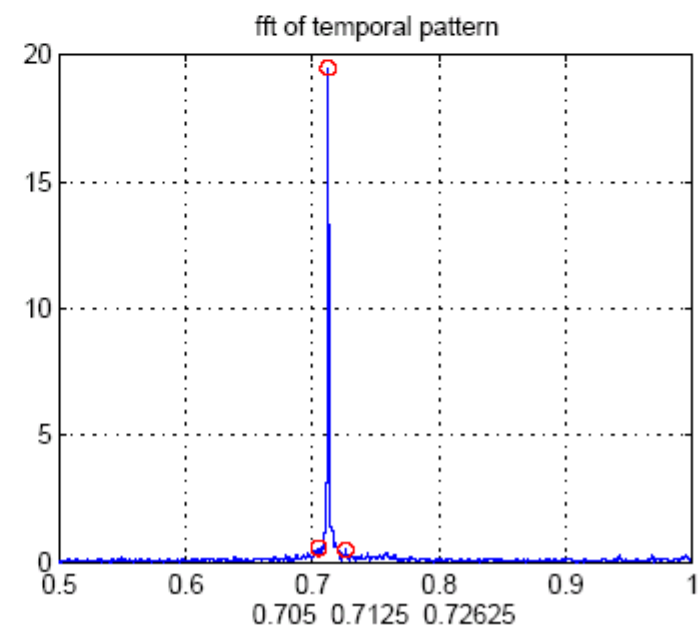
Student Version of MATLAB

ICA Mode 4; tbt99581- 1915:800



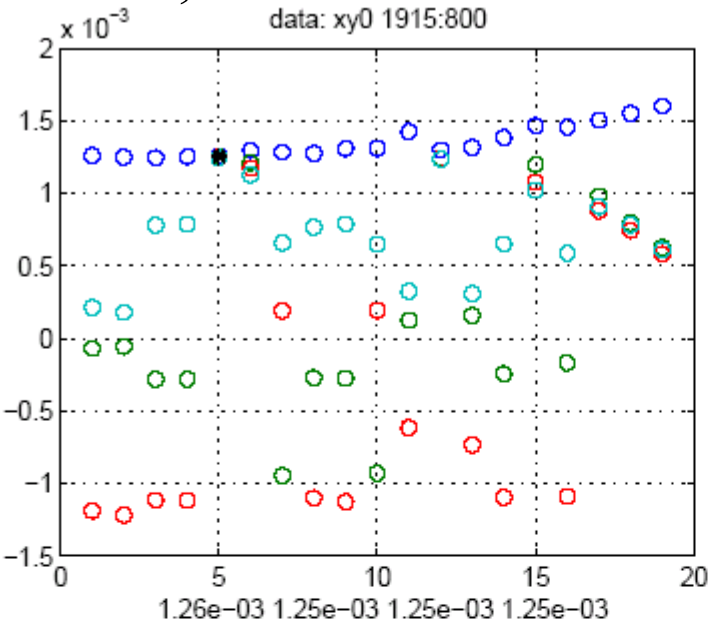


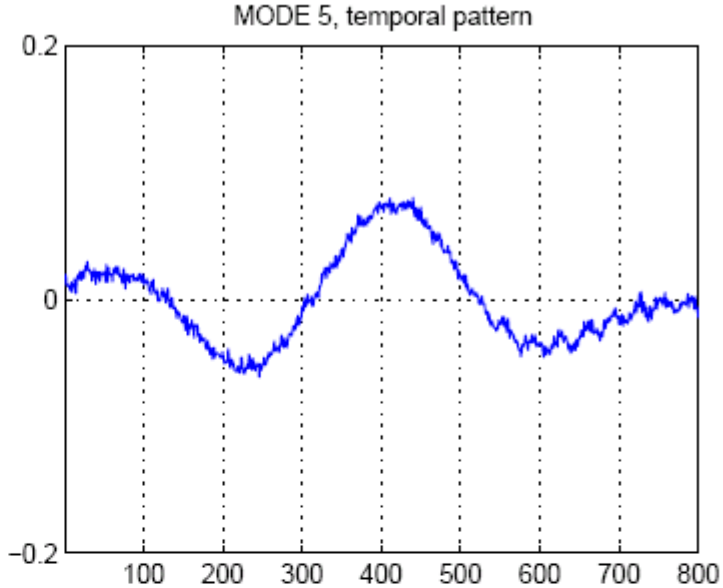


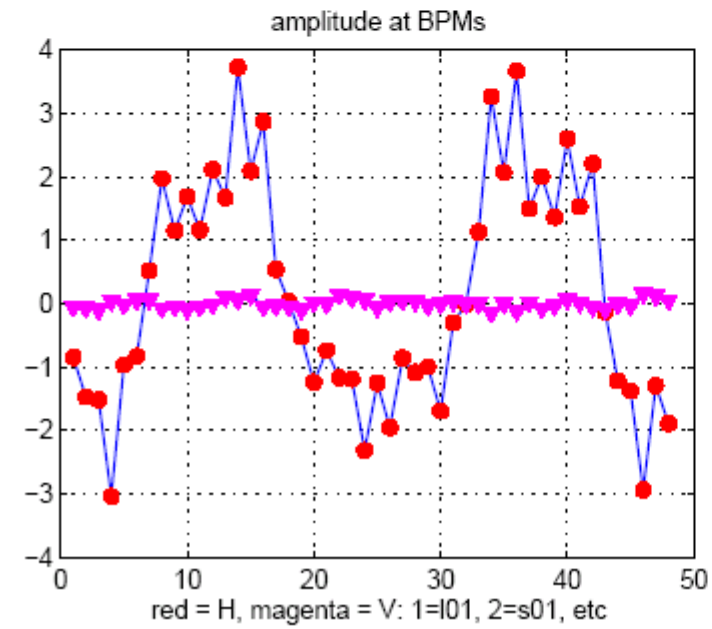


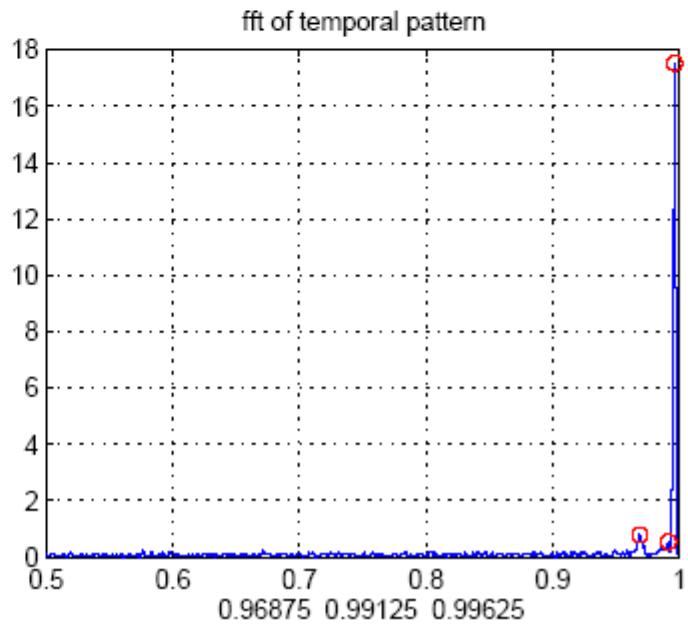
Student Version of MATLAB

ICA Mode 5; tbt99581- 1915:800









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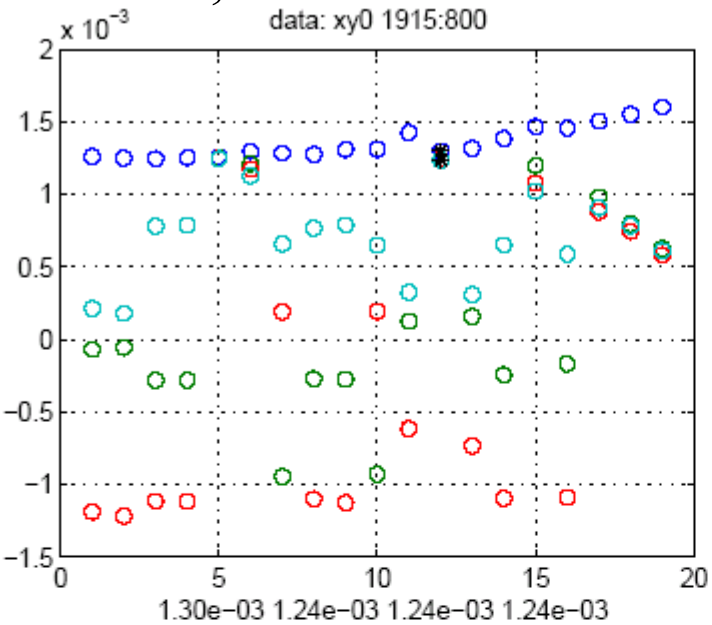
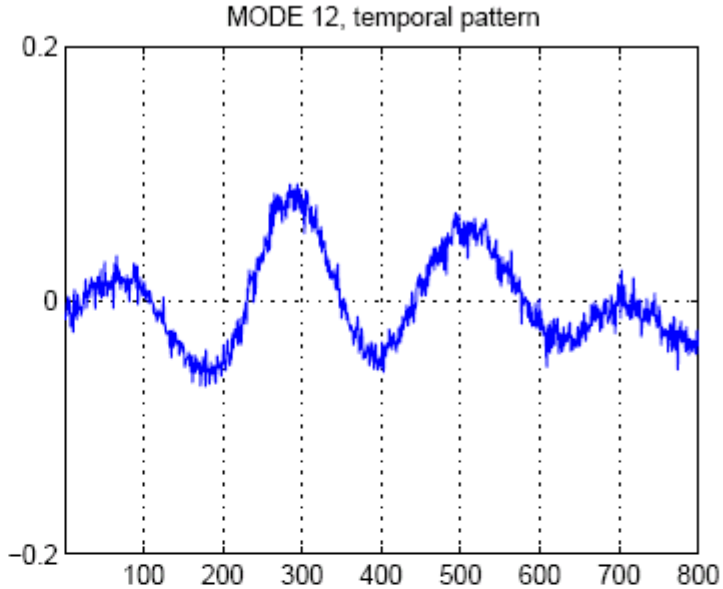
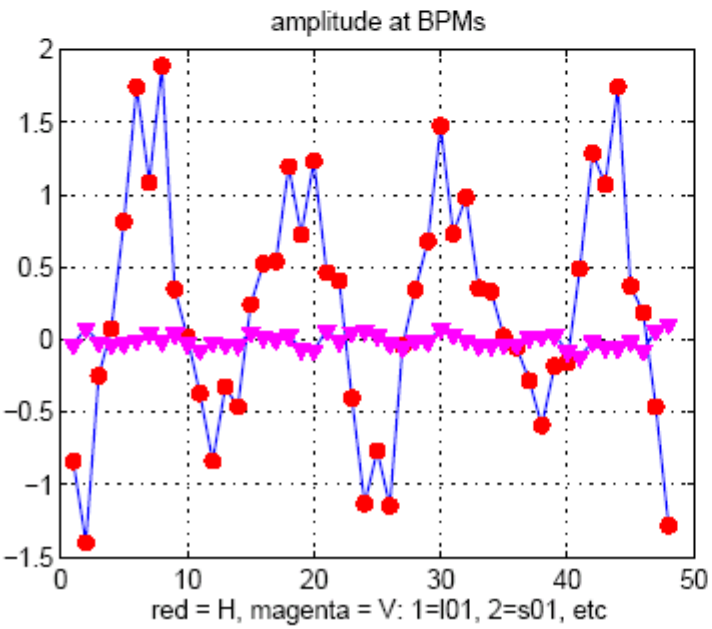
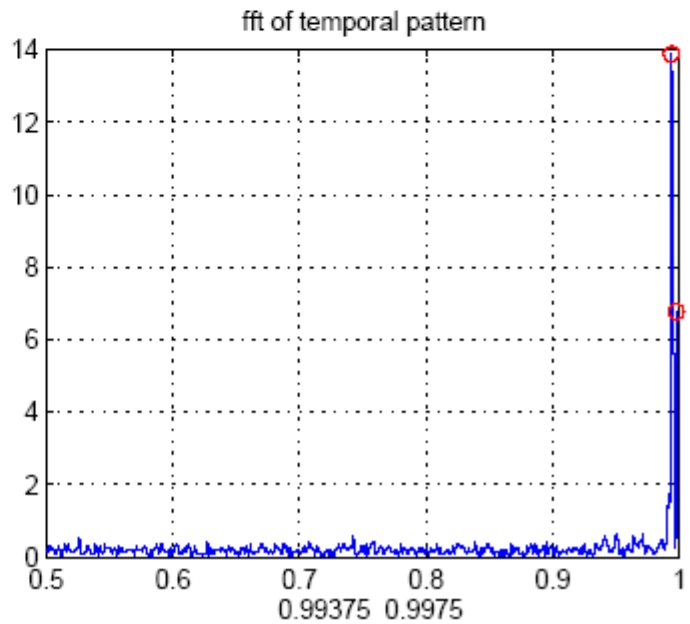
ICA Mode 12; tbt99581- 1915:800



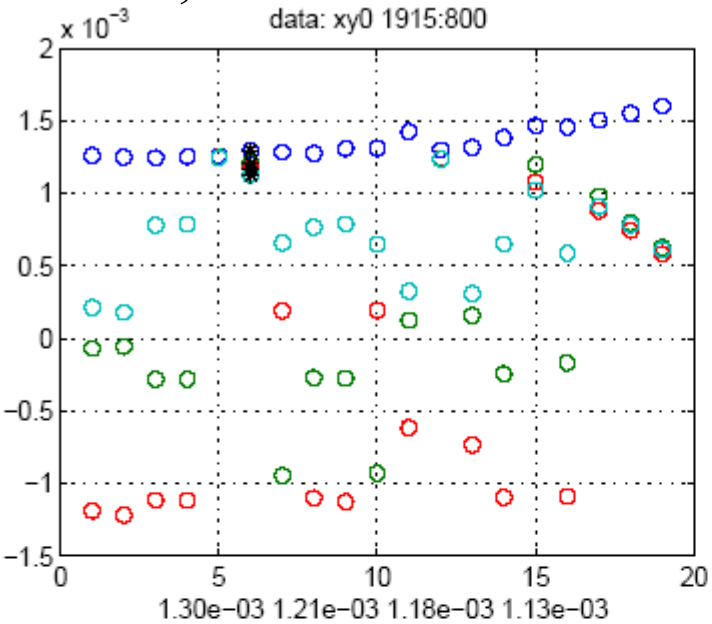


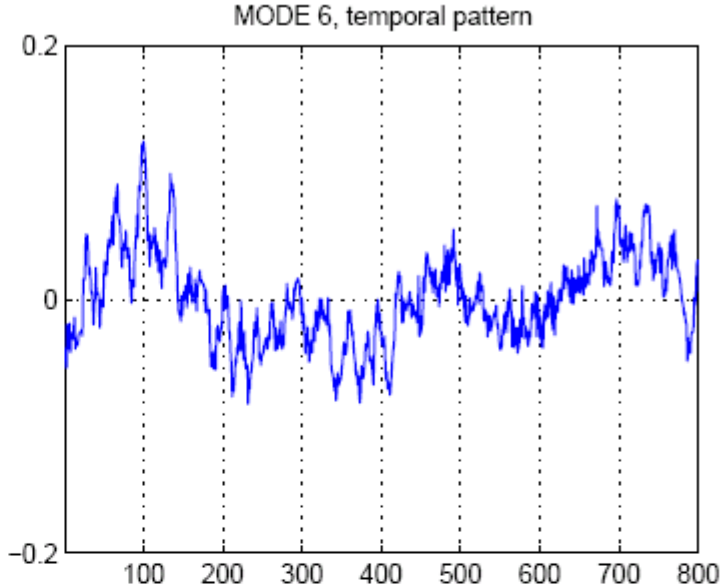


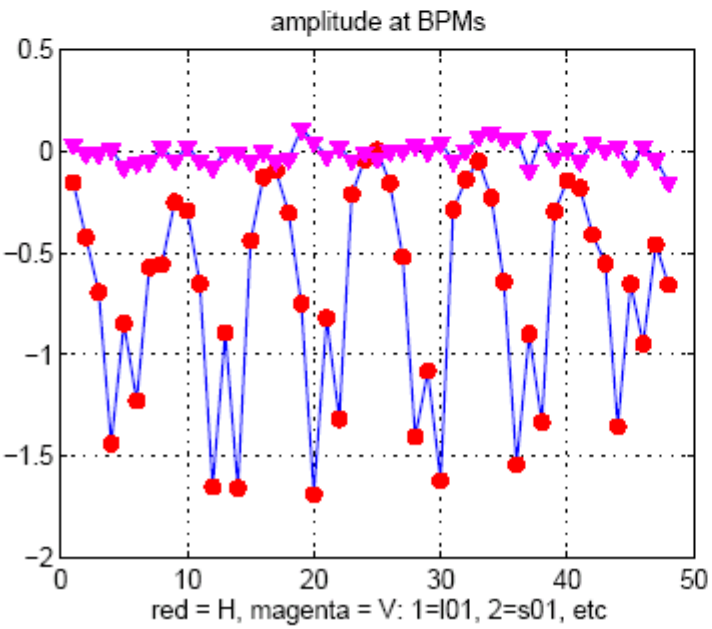


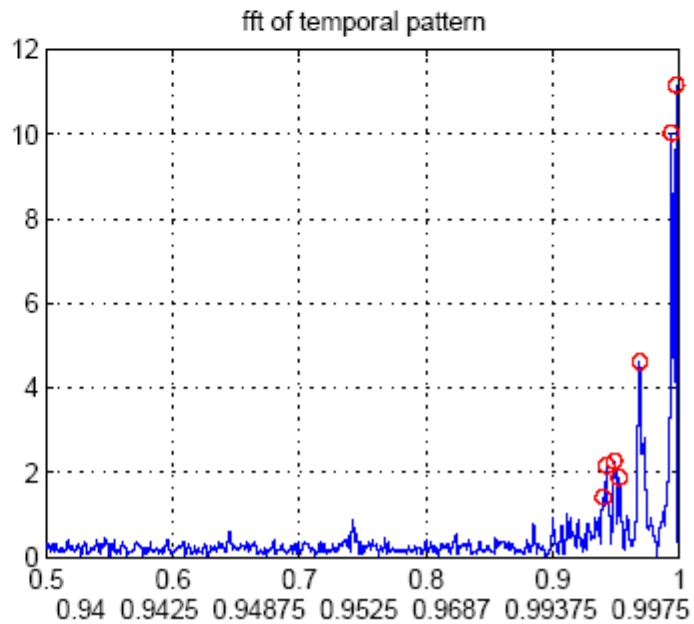
Student Version of MATLAB

ICA Mode 6; tbt99581- 1915:800

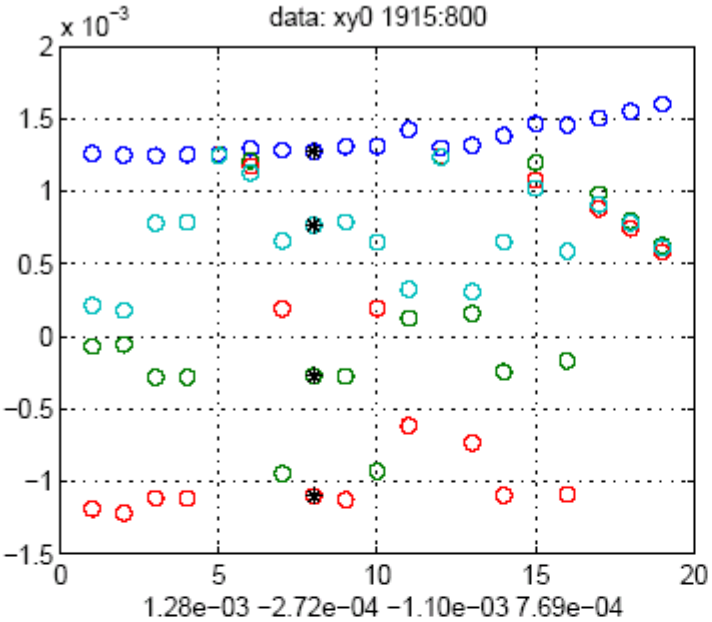


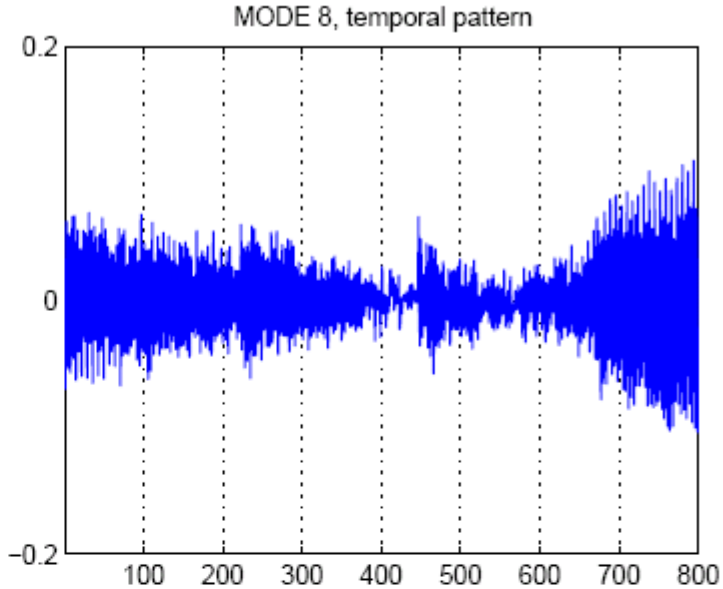


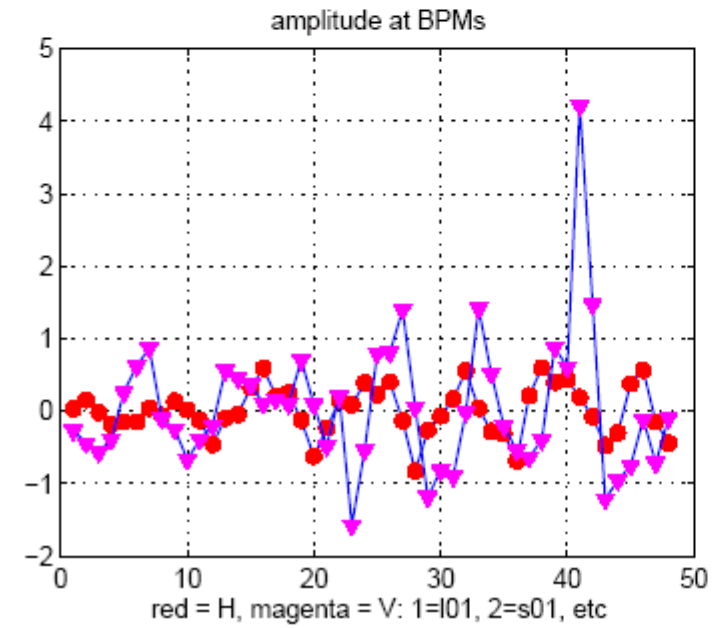


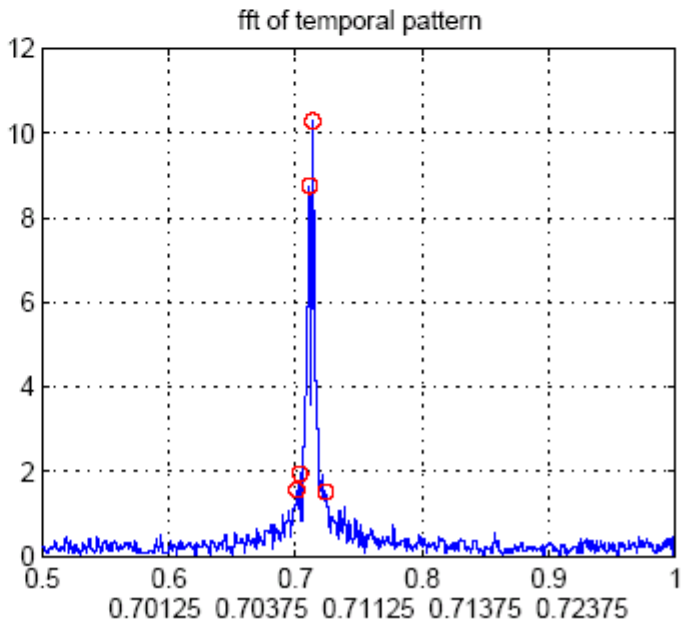


Student Version of MATLAB



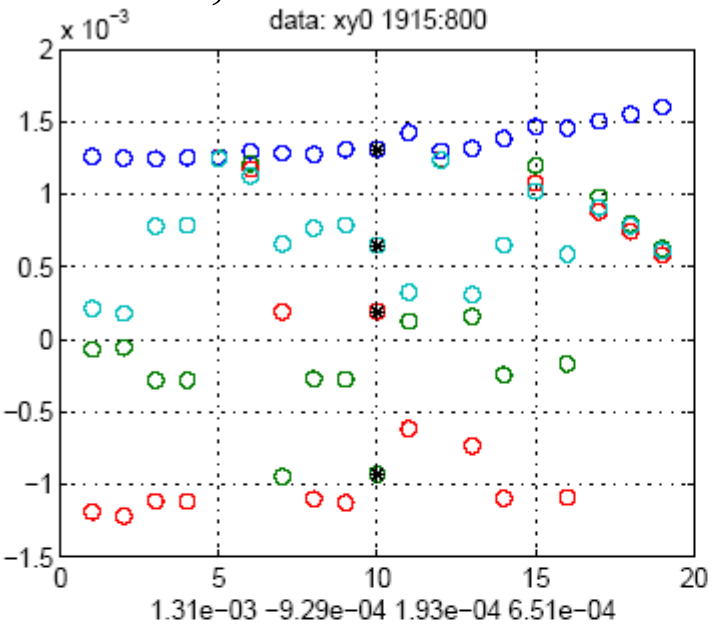


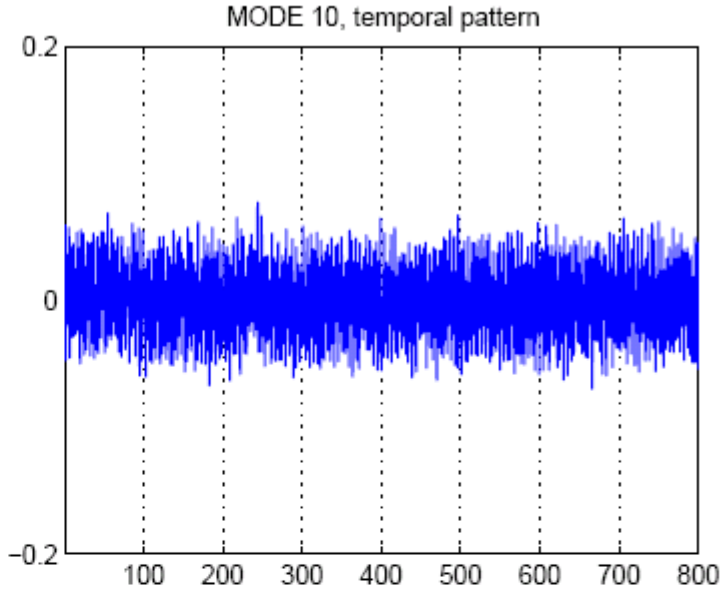


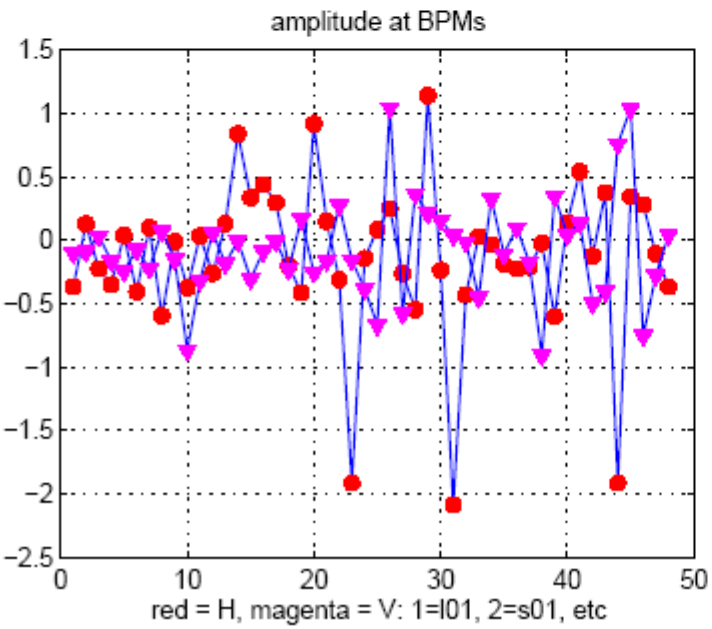


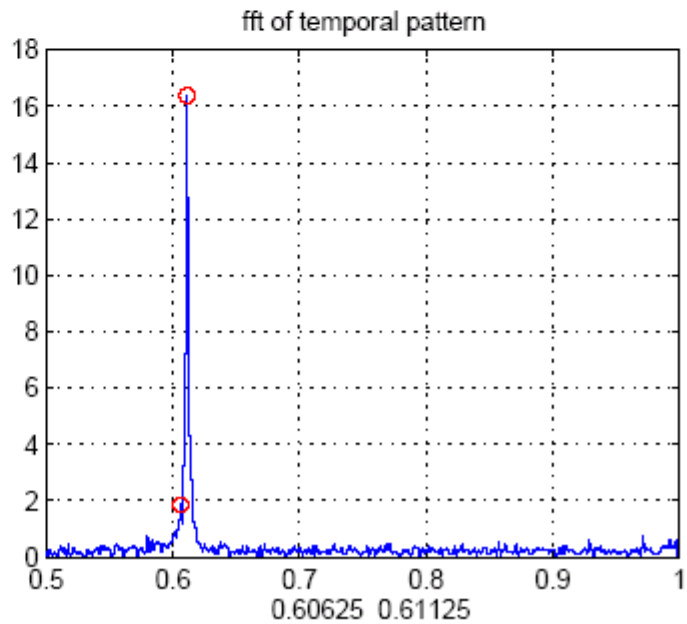
Student Version of MATLAB

ICA Mode 10; tbt99581- 1915:800



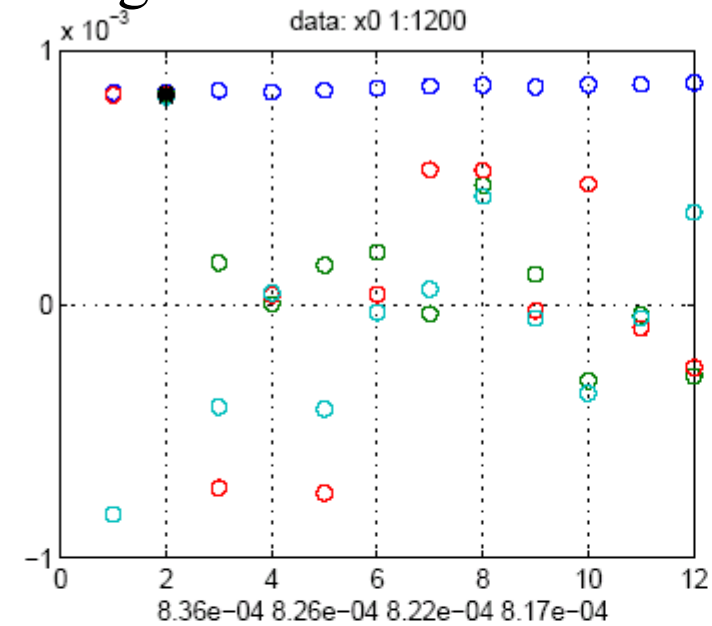


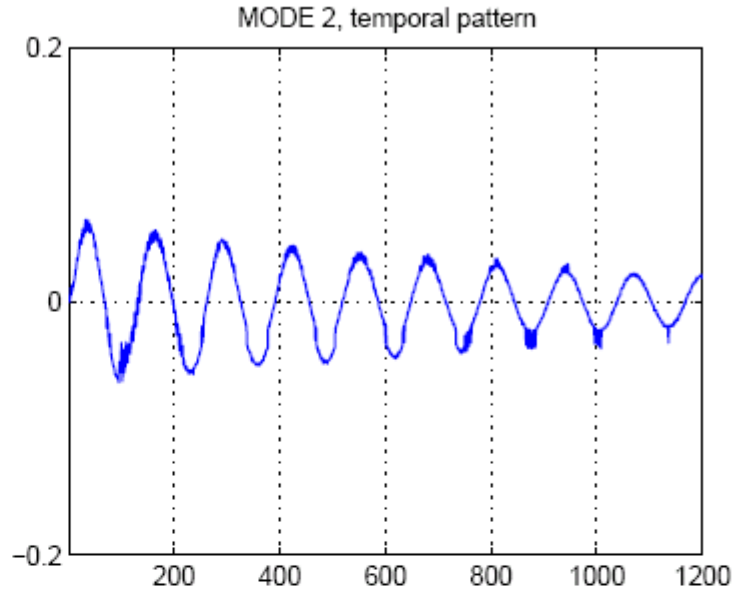


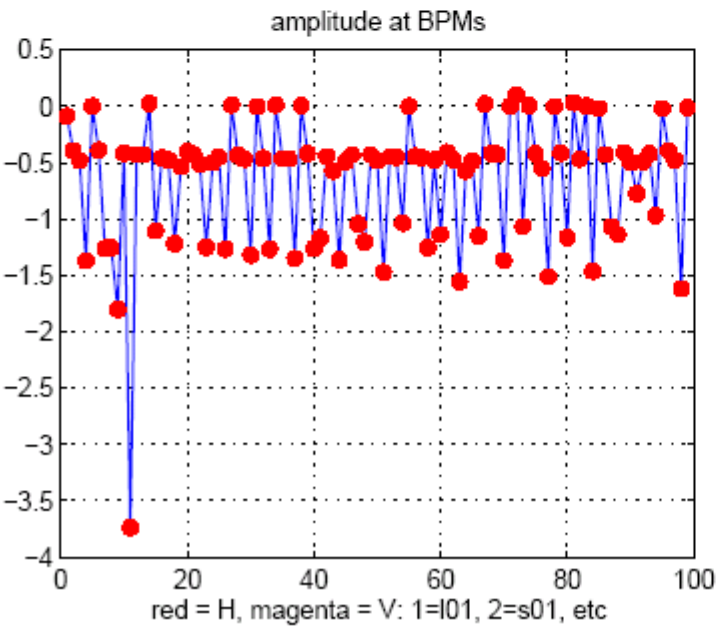


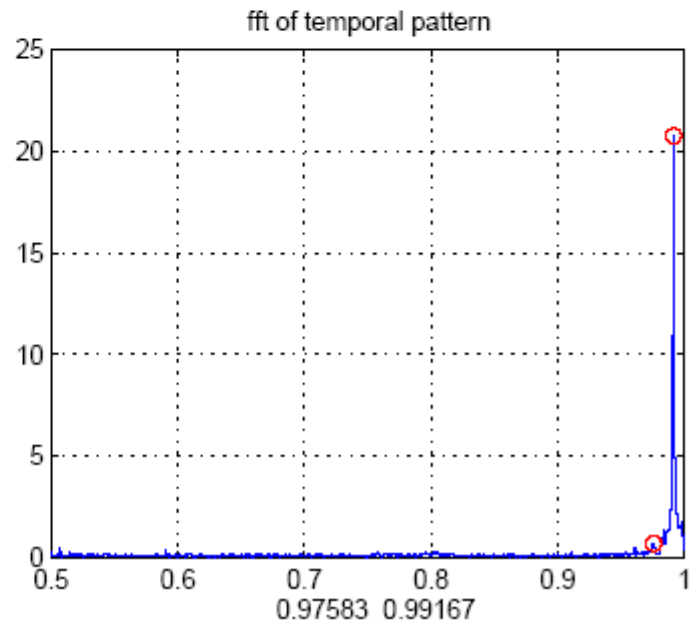
Student Version of MATLAB

ata from Argonne



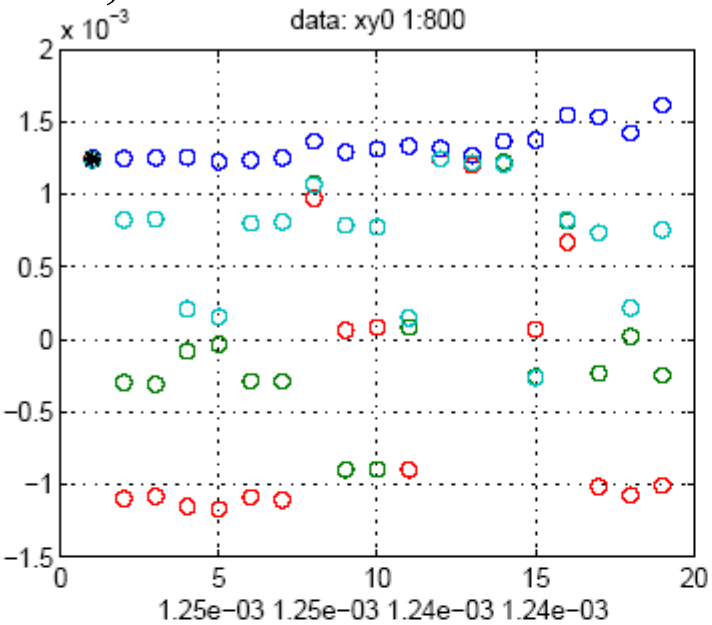


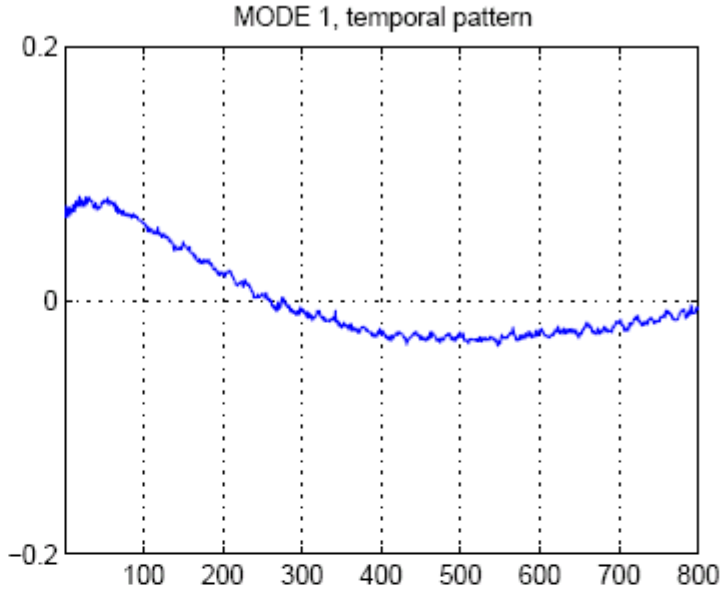


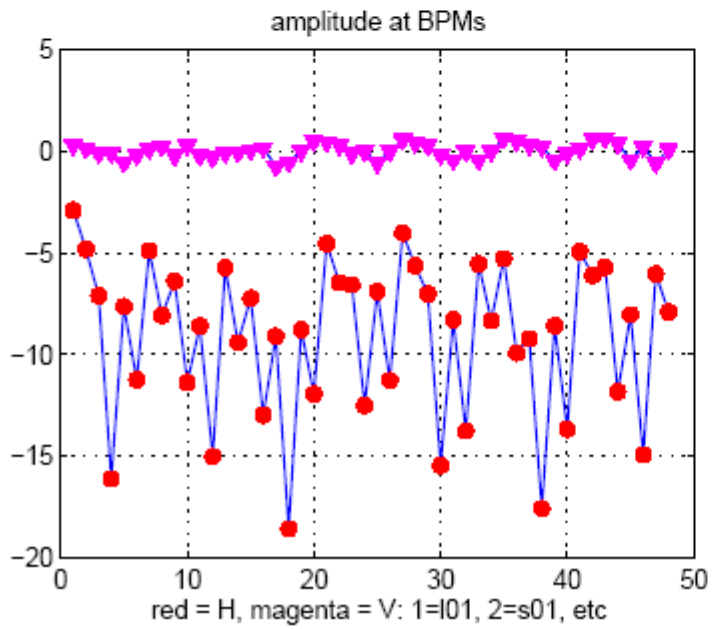


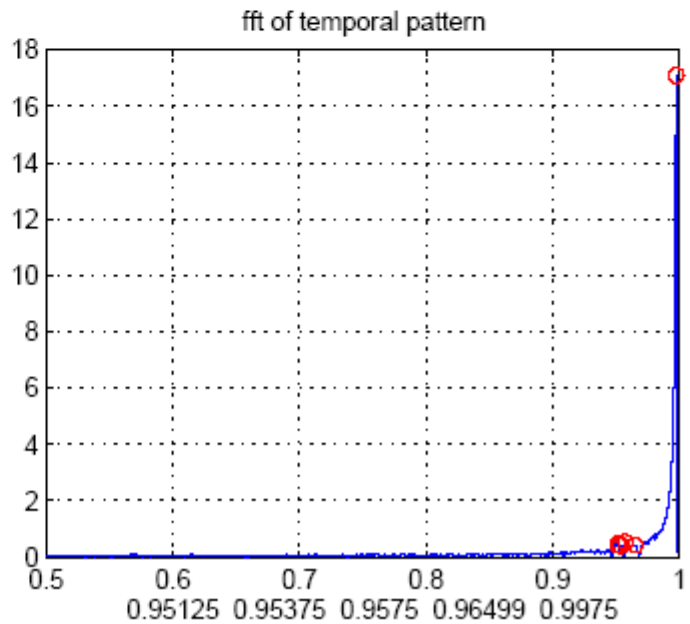
Student Version of MATLAB

ICA, XY0, 1:800 MODE 1



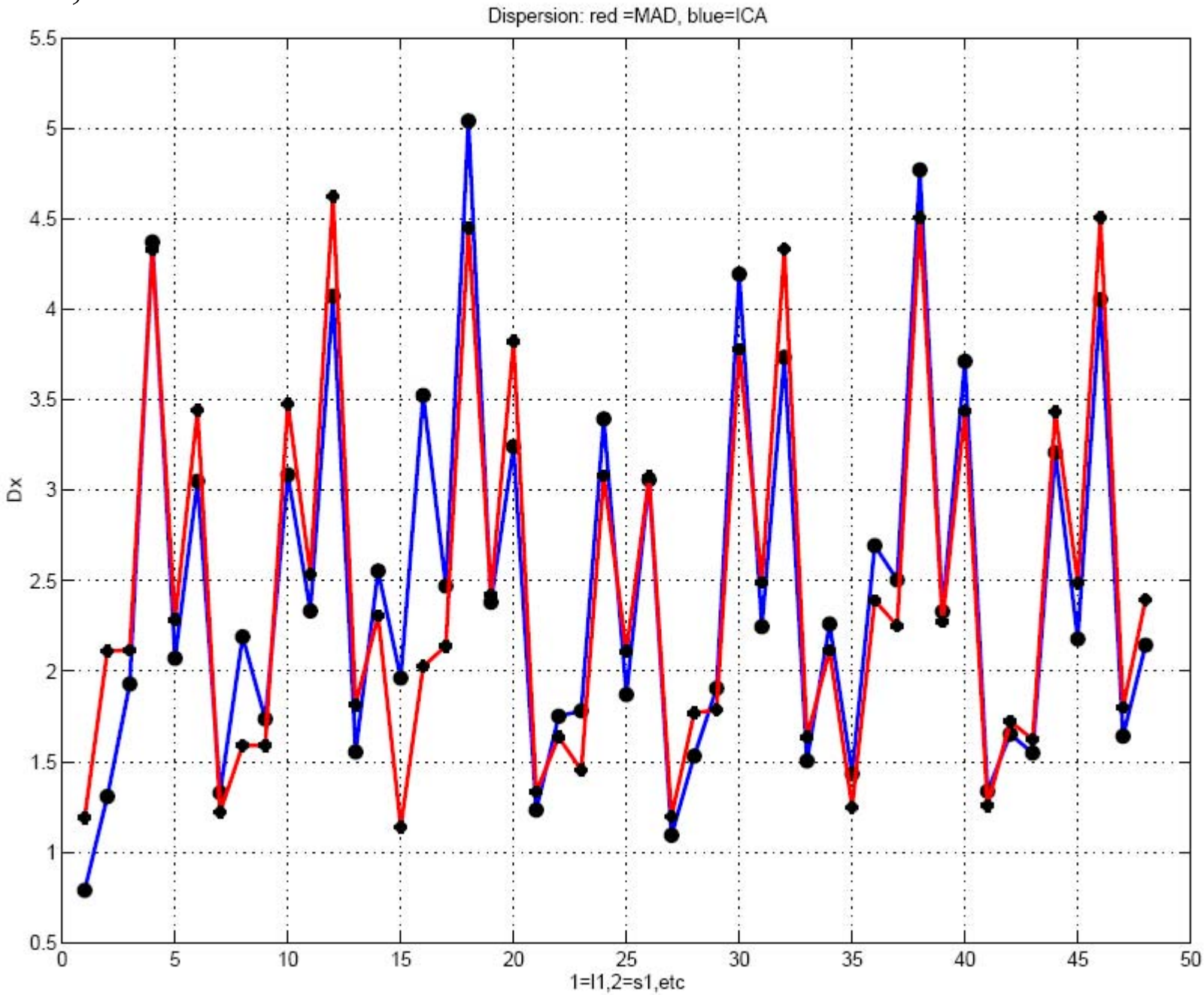


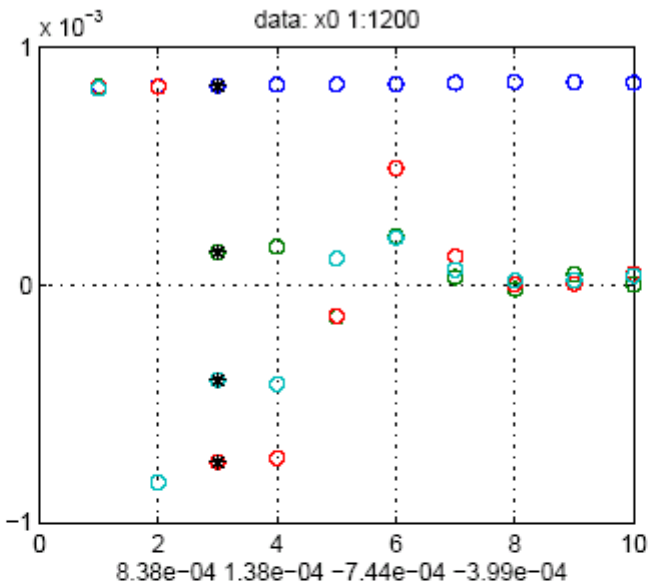


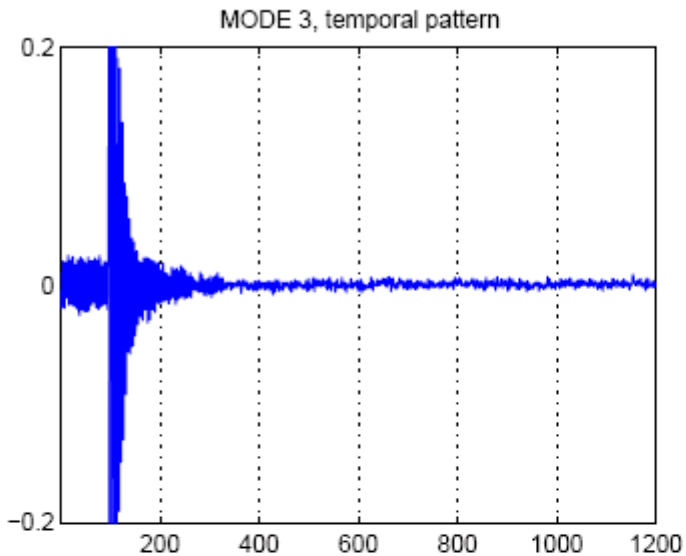


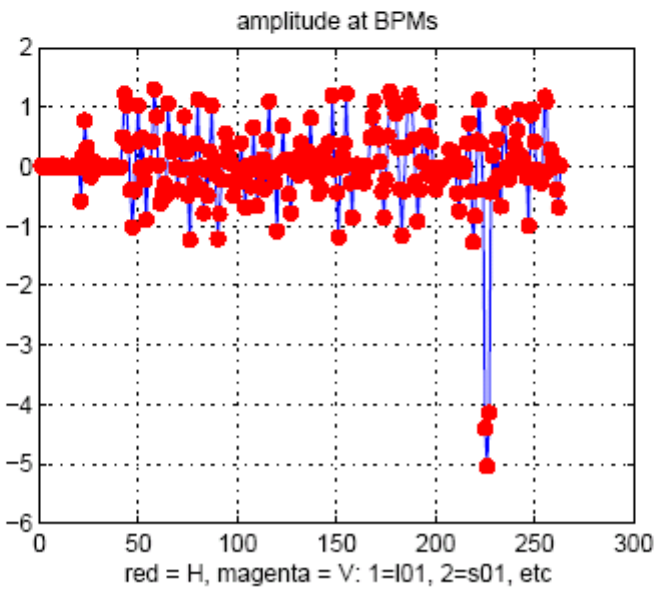
Student Version of MATLAB

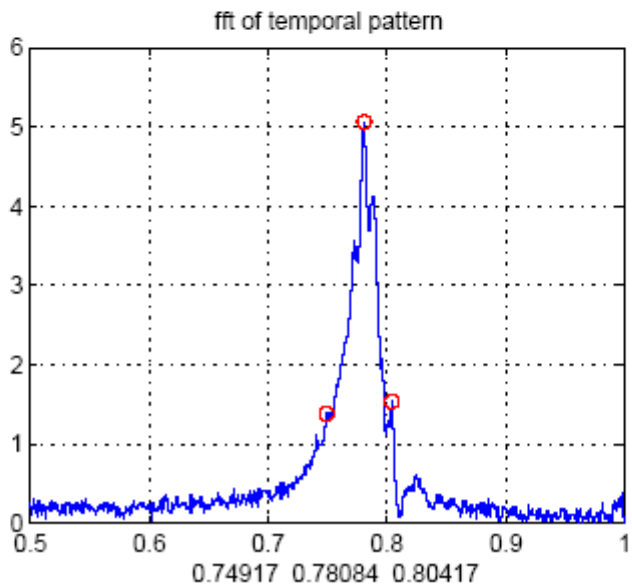
ICA, XY0, 1:800


Dispersion: red =MAD, blue=ICA
Dx
1=I1,2=s1,etc
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
0
5
10
15
20
25
30
35
40
45
50
Student Version of MATLAB

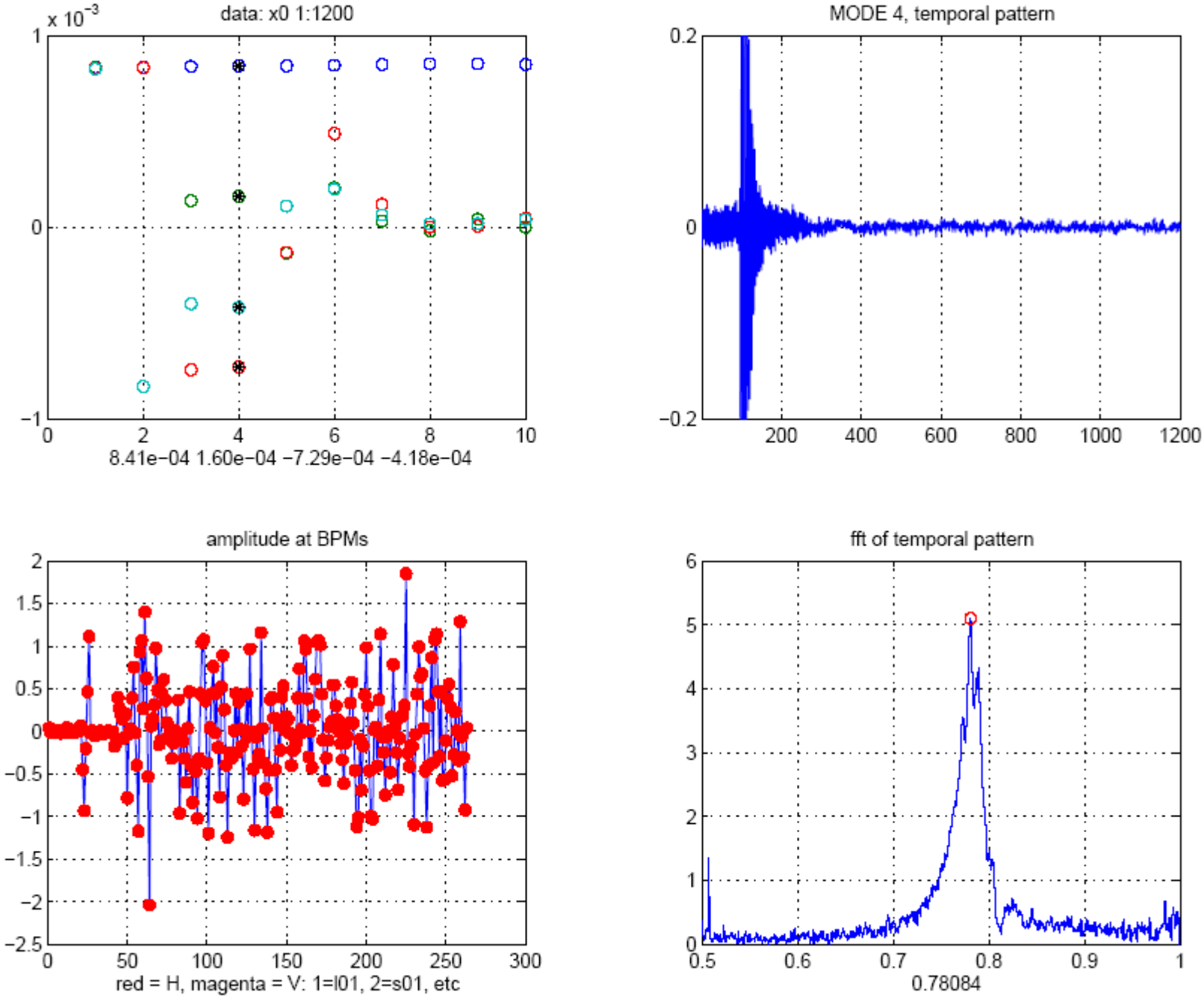








Student Version of MATLAB


data: x0 1:1200
x 10^-3
1
0
−1
0
2
4
6
8
10
8.41e−04 1.60e−04 −7.29e−04 −4.18e−04
MODE 4, temporal pattern
0.2
0
−0.2
200
400
600
800
1000
1200
amplitude at BPMs
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
0
50
100
150
200
250
300
red = H, magenta = V: 1=l01, 2=s01, etc
fft of temporal pattern
6
5
4
3
2
1
0
0.5
0.6
0.7
0.8
0.9
1
0.78084