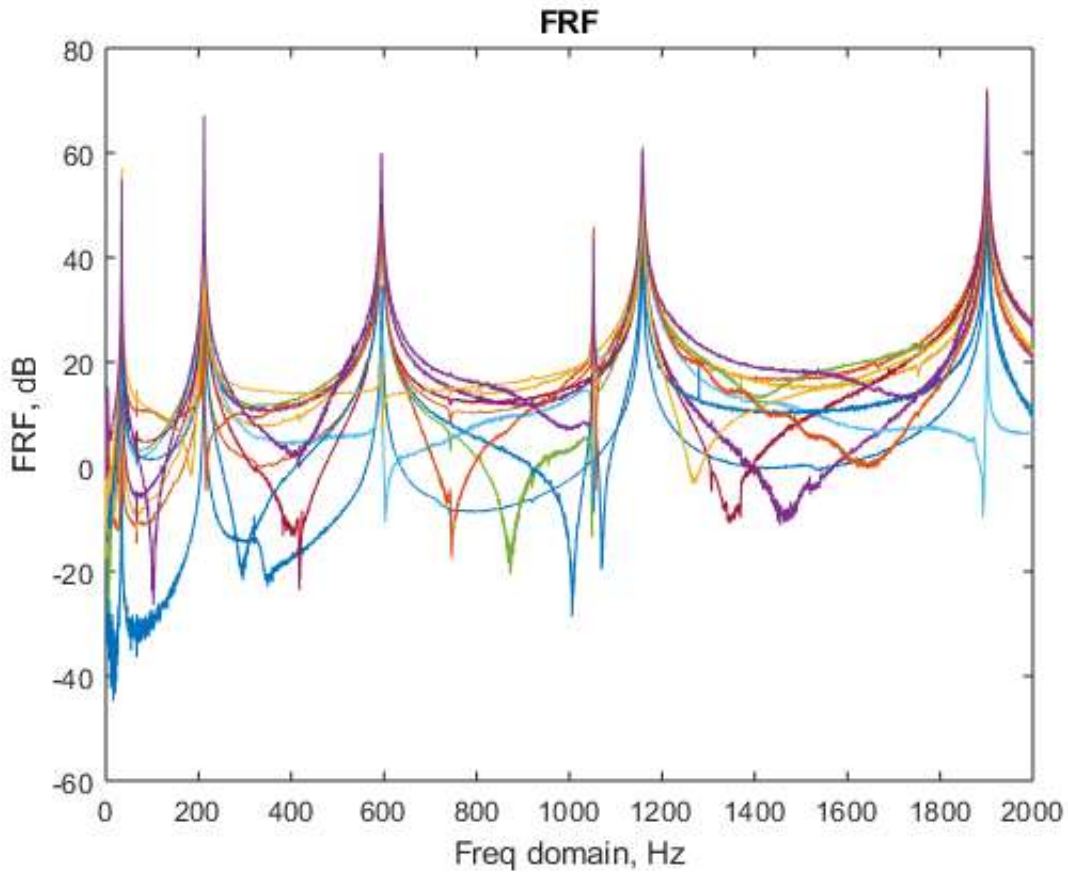
Contents


```
% ============================================== %
% Modal Assurance Criterion using cantilever beam %
% ============================================== %
% by: Santhosh Kumar Arroju Graduate Student at Wright State University
% used vibration tool box mdofcf for curve fitting and extract mode shapes

clc; close all; clear all;
```

load case files collected at 11 location points and extract mode shapes from vtoolbox

```
figure()
load case_1.mat
H1 = Hf_chan_2;
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_2.mat
H2 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_3.mat
H3 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_4.mat
H4 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_5.mat
H5 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_6.mat
H6 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_7.mat
H7 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_8.mat
H8 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_9.mat
H9 = Hf_chan_2; hold on
```

```
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_10.mat
H10 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))

load case_11.mat
H11 = Hf_chan_2; hold on
plot(Freq_domain,20*log10(abs(Hf_chan_2)))
xlabel('Freq domain, Hz');ylabel('FRF, dB')
title('FRF')

% close all
```

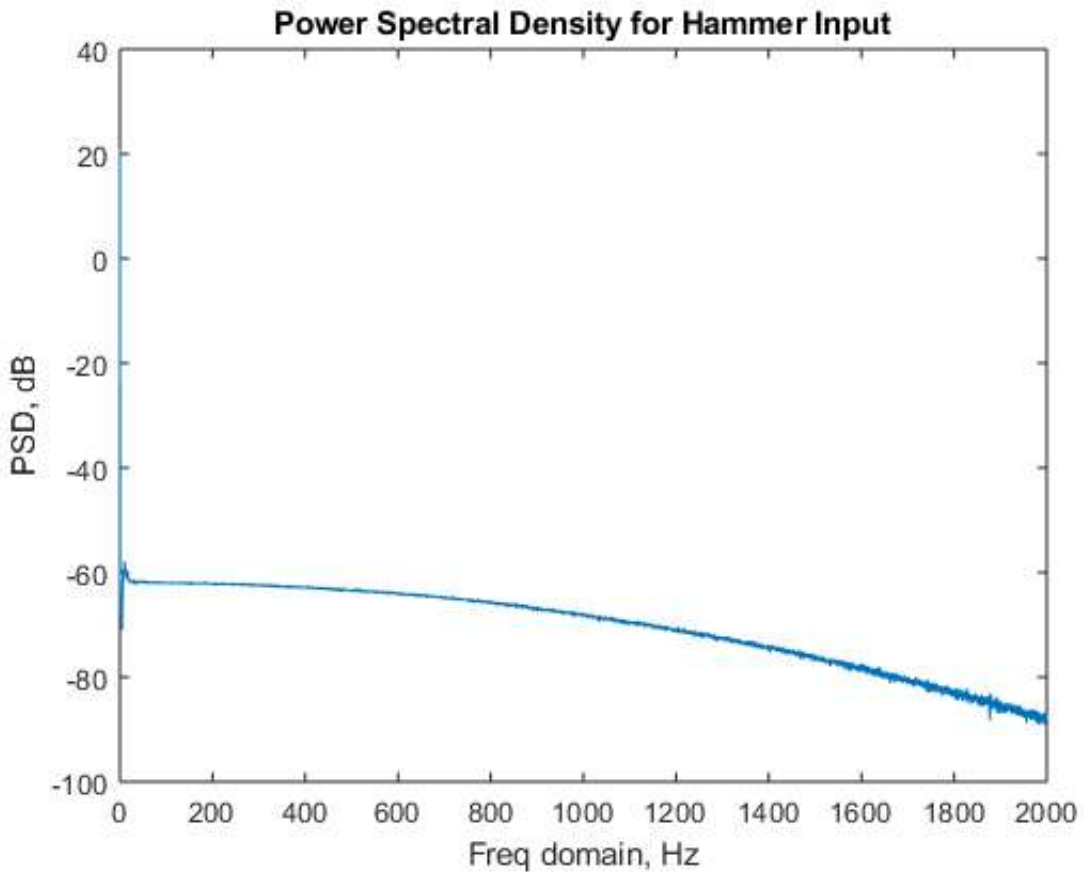


Power Spectral Density for Input Hammer

```
load case_2.mat
figure
plot(Freq_domain,20*log10(abs(PSD_chan_1)))
xlabel('Freq domain, Hz');ylabel('PSD, dB')
title('Power Spectral Density for Hammer Input')

TF = [H1,H2,H3,H4,H5,H6,H7,H8,H9,H10,H11];
f = Freq_domain;

[z1,nf1,u1]=mdofcf(f,TF,34.06-5,34.06+5);
[z2,nf2,u2]=mdofcf(f,TF,211.9-5,211.9+5);
[z3,nf3,u3]=mdofcf(f,TF,595-1,595+1);
```

```
[z4,nf4,u4]=mdofcf(f,TF,1158-0.2,1158+0.2);
[z5,nf5,u5]=mdofcf(f,TF,1901-0.2,1901+0.2);
```

```
Warning: Rank deficient, rank = 4, tol =  3.177783e+01.
Warning: Rank deficient, rank = 2, tol =  6.684570e-04.
Warning: Rank deficient, rank = 4, tol =  1.187149e+03.
Warning: Rank deficient, rank = 2, tol =  6.684570e-04.
Warning: Rank deficient, rank = 4, tol =  1.066875e+03.
Warning: Rank deficient, rank = 2, tol =  7.629395e-05.
Warning: Rank deficient, rank = 4, tol =  9.277002e+02.
Warning: Rank deficient, rank = 2, tol =  1.752012e-05.
Warning: Rank deficient, rank = 4, tol =  2.500203e+03.
Warning: Rank deficient, rank = 2, tol =  1.752012e-05.
```



Mode shapes

```
figure
plot(1:11,u1,'LineWidth',5)
hold on
plot(1:11,u2,'LineWidth',5)
hold on
plot(1:11,u3,'LineWidth',5)
hold on
plot(1:11,u4,'LineWidth',5)
hold on
plot(1:11,u5,'LineWidth',5)
legend('mode shape 1','mode shape 2','mode shape 3','mode shape 4','mode shape 5')
```

```
title('Mode Shapes of Cantilever Beam')
```

```
Warning: Imaginary parts of complex X and/or Y arguments ignored
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```
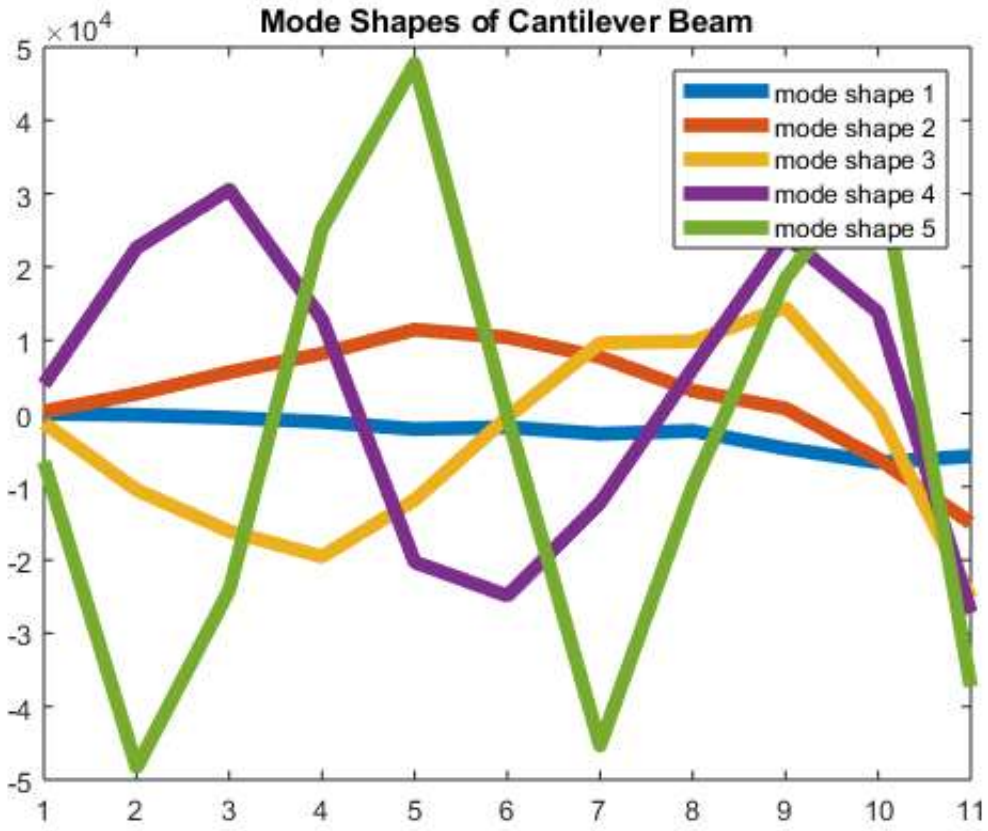
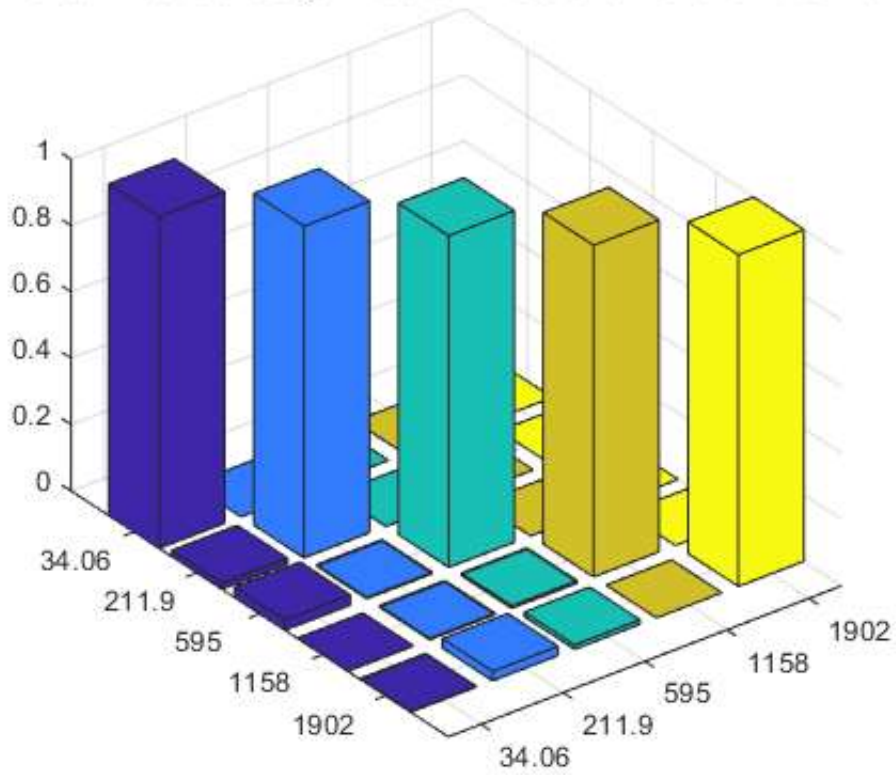



Modal Assurance Criterion for Test-Test data

```
U = [u1 u2 u3 u4 u5]

for i=1:5;
    for j=1:i;

MAC(i,j) = (abs(U(:,i)'*U(:,j)))^2 / ((U(:,i)'*U(:,i))*(U(:,j)'*U(:,j)));

    end
end
MAC
figure
bar3(MAC)
title('Test-Test data, Modal Assurance Criterion', 'fontweight','bold', 'fontsize',16)
set(gca,'XTickLabel',[34.06 211.9 595 1158 1902])
set(gca,'YTickLabel',[34.06 211.9 595 1158 1902])
```

```
U =

  11×5 single matrix

   1.0e+04 *

  Columns 1 through 4

  -0.0020 - 0.0000i   0.0299 - 0.0000i  -0.1333 + 0.0000i   0.3943 - 0.0000i
  -0.0200 - 0.0000i   0.2670 - 0.0000i  -1.0434 + 0.0000i   2.2602 - 0.0002i
  -0.0586 - 0.0000i   0.5624 - 0.0001i  -1.6069 + 0.0000i   3.0567 - 0.0002i
  -0.1140 - 0.0000i   0.8167 - 0.0001i  -1.9543 + 0.0000i   1.2871 - 0.0001i
  -0.2125 - 0.0000i   1.1446 - 0.0001i  -1.1813 + 0.0000i  -2.0296 + 0.0002i
  -0.1881 - 0.0000i   1.0401 - 0.0001i  -0.0488 + 0.0000i  -2.4880 + 0.0002i
  -0.2778 - 0.0000i   0.7703 - 0.0001i   0.9630 - 0.0000i  -1.2187 + 0.0001i
  -0.2386 - 0.0000i   0.3097 - 0.0000i   0.9834 - 0.0000i   0.6152 - 0.0000i
  -0.4779 - 0.0000i   0.0674 - 0.0000i   1.4505 - 0.0000i   2.4235 - 0.0002i
  -0.6666 - 0.0000i  -0.6162 + 0.0001i   0.0213 - 0.0000i   1.3790 - 0.0001i
  -0.5832 - 0.0000i  -1.4958 + 0.0002i  -2.5259 + 0.0000i  -2.7239 + 0.0002i

  Column 5

  -0.6565 + 0.0000i
  -4.8318 + 0.0003i
  -2.4093 + 0.0002i
   2.5181 - 0.0001i
   4.7784 - 0.0003i
  -0.0355 + 0.0000i
  -4.5340 + 0.0003i
  -0.9905 + 0.0000i
   1.8403 + 0.0000i
   3.5012 - 0.0002i
  -3.7293 + 0.0002i


MAC =

  5×5 single matrix

    1.0000         0         0         0         0
    0.0183    1.0000         0         0         0
    0.0309    0.0040    1.0000         0         0
    0.0010    0.0042    0.0077    1.0000         0
    0.0026    0.0281    0.0131    0.0001    1.0000
```



Published with MATLAB® R2018a