Contents


```
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% MAE 321 - HW 8.2
% 03/18/15

clear all
close all
clc
```

Problem 2:

For the example we did in class on 4 March, use Matlab to plot the transmissibility ratio for a range of damping coefficients. Use at least 5 values of c, and they should mostly span the range for underdamped responses. Include figures both for the transmissibility plotted as a function of the base excitation frequency, and as a function of the frequency ratio. (reminder: $m = 100kg,\ k = 2000N/m,\ Y = 0.03m,\ \omega_b = 6rad/s$)

Known

$m,\ k,\ Y,\ \omega_b$

```
mass          = 100;  % kg
stiffness     = 2000; % N/m
amplitudeBase = 0.03; % m
num = 1000;
frequencyBase = linspace(0, 10, num);    % rad/s
```

Calculations

$$\omega_n = \sqrt{\frac{k}{m}}$$

$$r = \frac{\omega_b}{\omega_n}$$

$$\zeta = \frac{c}{2\sqrt{km}}$$

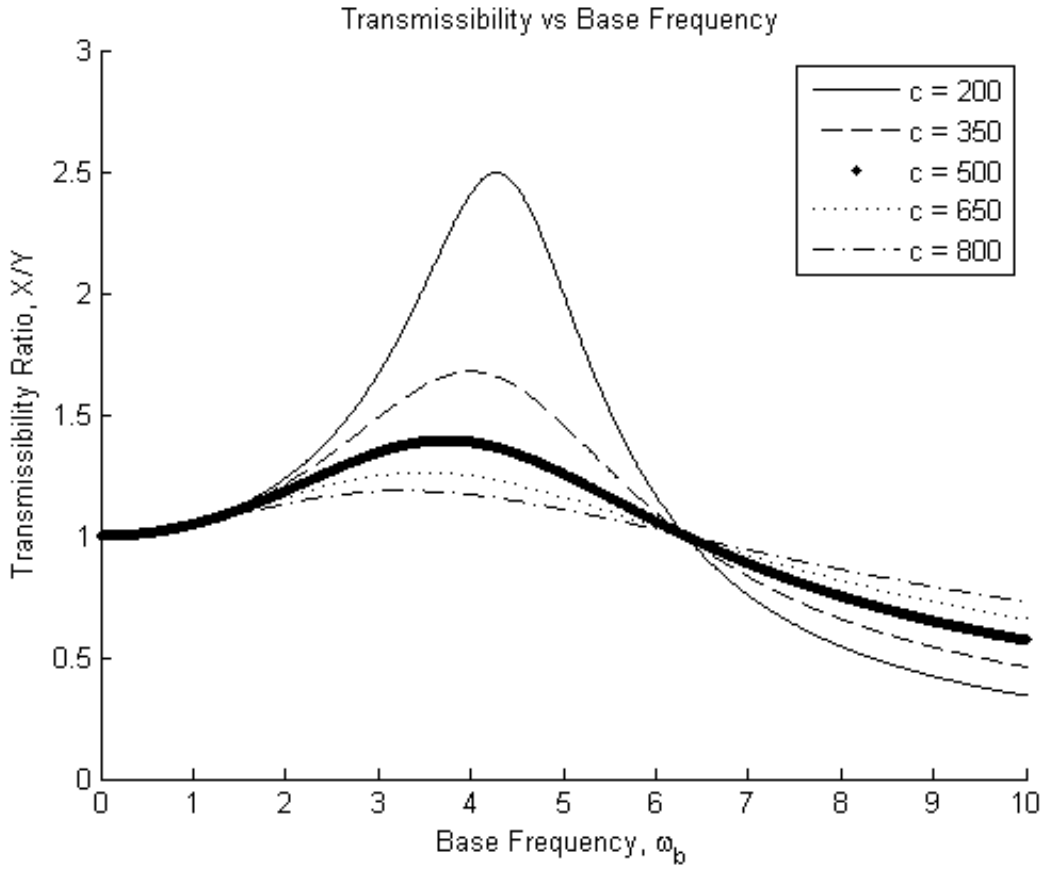
$$\frac{X}{Y} = \left[\frac{1 + (2\zeta r)^2}{(1 - r^2)^2 + (2\zeta r)^2}\right]^{1/2}$$

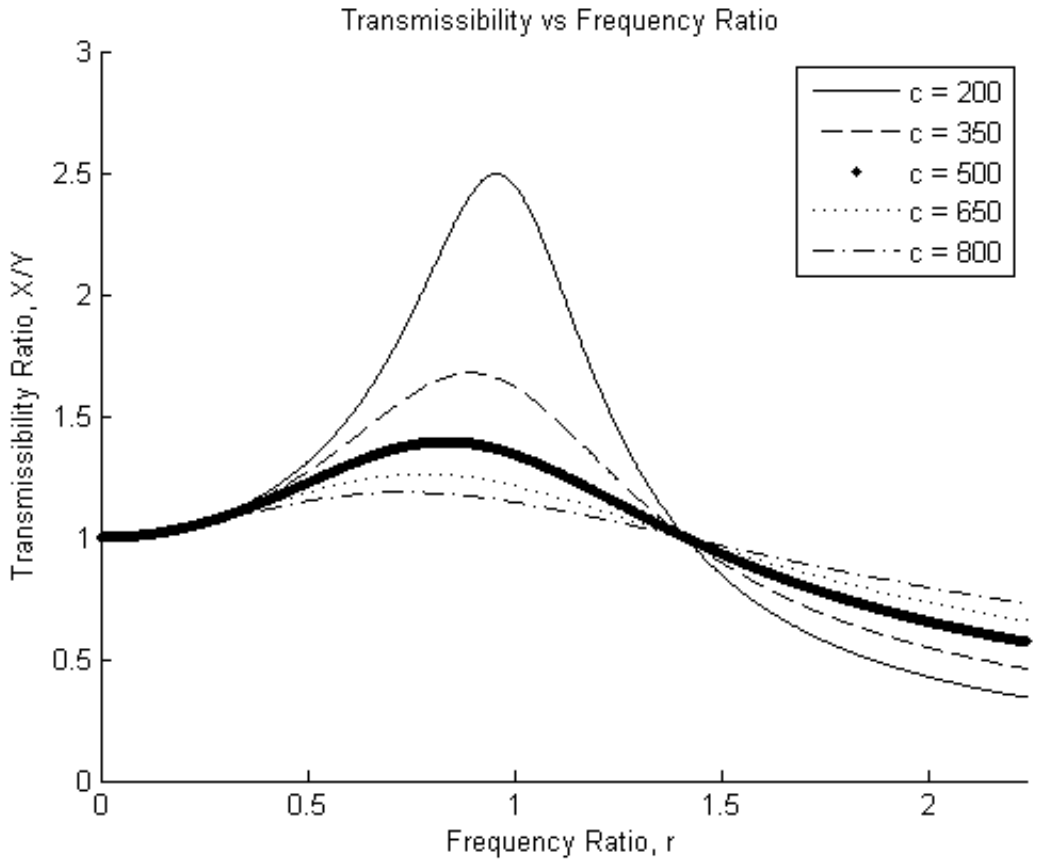
```
frequencyNatural = sqrt(stiffness / mass);
ratioFrequency   = frequencyBase ./ frequencyNatural;
ratioDamping     = @(c) c / (2 * sqrt(stiffness * mass));
```

```
ratioTrans       = @(c) sqrt((1 + (2 .* ratioDamping(c) .* ratioFrequency) .^ 2) ./...
                       ((1 - ratioFrequency .^ 2) .^ 2 ...
                      + (2 .* ratioDamping(c) .* ratioFrequency) .^ 2));


coefficientDamping = linspace(200, 800, 5);
transmissibility   = zeros(num, 5);

for n = [1 : 5]

    transmissibility(:, n) = ratioTrans(coefficientDamping(n));

end
```

Plots

```
figure(1)
hold on
xlabel('Base Frequency, \omega_b')
ylabel('Transmissibility Ratio, X/Y')
title('Transmissibility vs Base Frequency')
axis([0 frequencyBase(end) 0 3])

plot(frequencyBase, transmissibility(:, 1), '-', 'color', [0 0 0])
plot(frequencyBase, transmissibility(:, 2), '--', 'color', [0 0 0])
plot(frequencyBase, transmissibility(:, 3), '.', 'color', [0 0 0])
plot(frequencyBase, transmissibility(:, 4), ':', 'color', [0 0 0])
plot(frequencyBase, transmissibility(:, 5), '-.', 'color', [0 0 0])

legend('c = 200', 'c = 350', 'c = 500', 'c = 650', 'c = 800')


figure(2)
hold on
xlabel('Frequency Ratio, r')
ylabel('Transmissibility Ratio, X/Y')
title('Transmissibility vs Frequency Ratio')
axis([0 ratioFrequency(end) 0 3])

plot(ratioFrequency, transmissibility(:, 1), '-', 'color', [0 0 0])
plot(ratioFrequency, transmissibility(:, 2), '--', 'color', [0 0 0])
plot(ratioFrequency, transmissibility(:, 3), '.', 'color', [0 0 0])
plot(ratioFrequency, transmissibility(:, 4), ':', 'color', [0 0 0])
plot(ratioFrequency, transmissibility(:, 5), '-.', 'color', [0 0 0])

legend('c = 200', 'c = 350', 'c = 500', 'c = 650', 'c = 800')
```


Transmissibility vs Base Frequency
c = 200
c = 350
c = 500
c = 650
c = 800
Transmissibility Ratio, X/Y
Base Frequency, ω_b
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6
7
8
9
10


Transmissibility vs Frequency Ratio
c = 200
c = 350
c = 500
c = 650
c = 800
Transmissibility Ratio, X/Y
Frequency Ratio, r
0
0.5
1
1.5
2
2.5
3
0
0.5
1
1.5
2

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