Contents


```
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% MAE 321 - HW 8.1
% 03/18/15

clear all
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clc
```

Problem 1:

A machine modeled as a linear spring-mass-damper system, is driven at resonance ($\omega_n = \omega = 2.5\ rad/s$). Design a damper (choose a value of c) so that the maximum deflection at steady state is 0.05 m. The machine is modeled as having a stiffness of 1700 N/m, and the excitation force has a magnitude of 150 N.

Find: Design System, c

Known

$\omega_n,\ \omega,\ X,\ k,\ F_0$

```
frequencyNatural = 2.5;              % rad/s
frequencyDriving = frequencyNatural; % rad/s
amplitudeSS      = 0.05;             % m
stiffness        = 1700;             % N/m
forceDriving     = 150;              % N
```

Calculations

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

$$m = \frac{k}{\omega_n^2}$$

Steady State Amplitude:

$$X = \frac{f_0}{\sqrt{(\omega_n^2 - \omega^2) + (2\zeta\omega_n\omega)^2}} = \frac{f_0}{2\zeta\omega^2} = \frac{f_0\sqrt{km}}{c\omega^2}$$

$$c = \frac{f_0\sqrt{km}}{X\omega^2}$$

```
mass                = stiffness / frequencyNatural ^ 2;
forceDrivingMassStd = forceDriving / mass;
coefficientDamping  = (forceDrivingMassStd * sqrt(stiffness * mass)) / ...
                      (amplitudeSS * frequencyDriving ^ 2)
```

```
coefficientDamping =

        1200
```

Results

System can be designed using a damper with a damping coefficient $c = 1200$.

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