Contents


```
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% MAE 321 - HW 8.3
% 03/18/15

clear all
close all
clc
```

Problem 3:

Consider the simple model of a building subject to ground motion suggested in Figure P2.60. The building is modeled as a single-degree-of-freedom spring–mass system where the building mass is lumped atop two beams used to model the walls of the building in bending. Assume the ground motion is modeled as having amplitude of 0.1 m at a frequency of 7.5 rad/s. Approximate the building mass by 10^5 kg and the stiffness of each wall by 3.519 * 10^6 N/m. Compute the magnitude of the deflection of the top of the building.

Find: X

Known

$Y,\ \omega,\ m,\ k$

```
amplitudeBase = 0.1;
frequencyForcing = 7.5;
mass             = 10 ^ 5;
stiffness        = 3.519 * 10 ^ 6;
```

Calculations

$$\omega_n = \sqrt{\frac{k_{eff}}{m}}$$

$$k_{eff} = 2k$$

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

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

Undamped System -> $\zeta = 0$

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

```
frequencyNatural = sqrt(2 * stiffness / mass);
ratioFrequency   = frequencyForcing / frequencyNatural;
amplitudeTop     = amplitudeBase * sqrt(1 / (1 - ratioFrequency ^ 2) ^ 2)
```

```
amplitudeTop =

    0.4981
```

Results

The magnitude of the deflection at the top of building with the given conditions is 0.4981 m.

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