

Contents

- Problem 3:
- Known
- Calculations
- Results

```
% Joel Lubinitsky - 02/04/15  
% MAE 321 - HW 3.3
```

```
clear all  
close all  
clc
```

Problem 3:

A helicopter landing gear consists of a metal framework rather than the coil spring based suspension system used in a fixed-wing aircraft. The vibration of the frame in the vertical direction can be modeled by a spring made of a slender bar, such as the one illustrated in Figure 1.23 of the textbook. Here $l = 0.4$ m, $E = 20 \times 10^{10}$ N/m², and $m = 100$ kg. Calculate the cross-sectional area that should be used if the natural frequency is to be $f_n = 600$ Hz.

Unknown: Cross-sectional area

Known

```
length          = 0.4;           % m  
modulusYoungs   = 20 * 10 ^ 10; % N/m ^ 2  
mass            = 100;           % kg  
frequencyNaturalHz = 600;       % Hz
```

Calculations

Rod with axial stiffness

$$k = \frac{EA}{l}$$

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

$$f_n = \frac{w_n}{2\pi}$$

Therefore,

$$A = \frac{4ml\pi^2 f_n^2}{E}$$

```
areaCrossSection = (4 * mass * length * pi ^ 2 * frequencyNaturalHz ^ 2) / modulusYoungs % m ^ 2
```

areaCrossSection =

0.0028

Results

Cross-sectional area $A = 0.0028 \text{ m}^2$

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