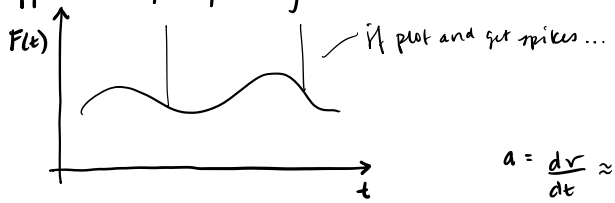
Assignment #2 due today

Vibrations - Lecture 9
2021-02-25

approaches for finding Force



$a = \frac{dv}{dt} \approx \frac{\Delta v}{\Delta t}$ ← what I did

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Assignment #3 Notes:

- think of masses suspended on vertical tracks, circles are wheels that allow masses to move freely in only horizontal direction
- one problem, 4 parts:
  - only the first bullet: ignore the variable m_3 (ignore the number) and think of the variable as alpha_1

⇒ we'll want to use atan2()

Watch lecture video for MATLAB demos of undamped free vibration using the general soln

$$\vec{x}(t) = \sum_{i=1}^{n} \vec{X}^{(i)} A_i \cos(\omega_i t + \phi_i)$$

with initial conditions

$$\vec{x}(0) = \begin{Bmatrix} x_1(0) \\ x_2(0) \\ \vdots \\ x_n(0) \end{Bmatrix} \qquad \dot{\vec{x}}(0) = \begin{Bmatrix} \dot{x}_1(0) \\ \dot{x}_2(0) \\ \vdots \\ \dot{x}_n(0) \end{Bmatrix}$$

$$\vec{x}(0) = \sum_{i=1}^{n} \vec{X}^{(i)} A_i \cos\phi_i \quad \text{and} \quad \dot{\vec{x}}(0) = -\sum_{i=1}^{n} \vec{X}^{(i)} A_i \omega_i \sin\phi_i$$

examine orthogonality:

$$A_i \cos\phi_i = \vec{X}^{(i)T}[m]\vec{x}(0) = B_i \quad \text{and} \quad A_i \sin\phi_i = -\vec{X}^{(i)T}[m]\dot{\vec{x}}(0)/\omega_i = C_i$$

to get soln for constants:

$$A_i = \sqrt{B_i^2 + C_i^2} \quad \text{and} \quad \phi_i = \tan^{-1}(C_i/B_i)$$

↑ need atan2 for this

... this all allows us to get x, $\dot{x}$, and $\ddot{x}$ (see assignment 3 and given function on BB)