

24-352 DYNAMIC SYSTEMS & CONTROL

HOMEWORK ASSIGNMENT #3

DUE 1/7/01

PROBLEMS

1. A turbine blade has a natural frequency of 500 Hz. The turbine has a speed range of 5000 to 12000 rpm. Draw a Campbell plot for this blade and circle all critical speeds. How would you change the frequency of this blade if you could alter it by no more than 10%.

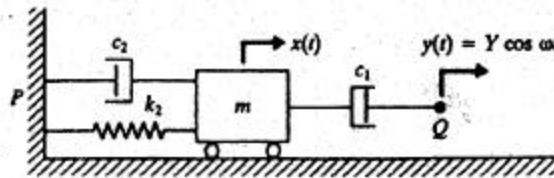


Figure 1

2. Consider the system of Figure 1. Use the complex exponential approach to determine the steady-state response to the cosine wave input.
3. Suppose that in the system shown in Figure 1, $y(t) = Y_0 H(t)$ where $H(t)$ is the "Heaviside step function" defined as

$$H(t) = \begin{cases} 0 & \text{if } t < 0 \\ 1 & \text{if } t \geq 0 \end{cases} \quad \text{and that } x(0) = 0 \text{ and } \dot{x}(0) = 0.$$

Assume that the system is underdamped.

- a. Find $x(t)$.
- b. If $m = k_2 = 1$, $c_1 = c_2 = 0.1$, and $Y_0 = 1$. Plot $x(t)$ for $0 < t < 0.5$.