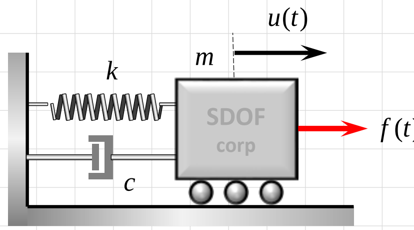
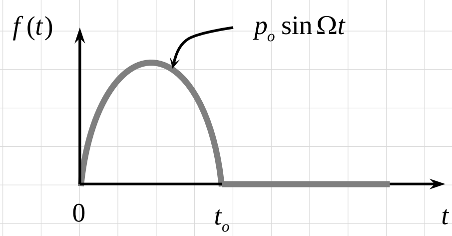
Homework 2

This homework problem concerns the response of a damped single degree of freedom system with mass m, stiffness k, and damping coefficient c subjected to external force $f(t)$. Let us assume that the load has the form of the first lobe of a sinusoidal function followed by no force, as shown in the sketch. The functional form of the forcing function is



Damped System

$$f(t) = \begin{cases} p_o \sin \Omega t & 0 < t < t_o \\ 0 & t_o < t \end{cases}$$



where Ω is the driving frequency p_o is the amplitude of the forcing function and t_o is the duration of the non-zero part of the loading. What does the driving frequency have to be in order for the forcing function to fit the duration given?

To model the different features of an impulsive load we can adjust the duration and the amplitude. Compute the response of this system and find the maximum displacement (and the time at which it occurs) as a function of the problem parameters. You might want to display the result in the form of what is known as a *response spectrum* (a plot of maximum response as a function of, say, natural frequency).

Study the features of this system to see if you can draw any design conclusions from the special features of the response. Does duration matter? Is the area under the load-time curve and important organizing value for the response plots?