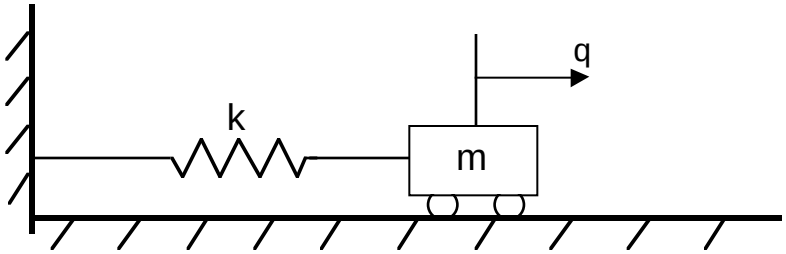
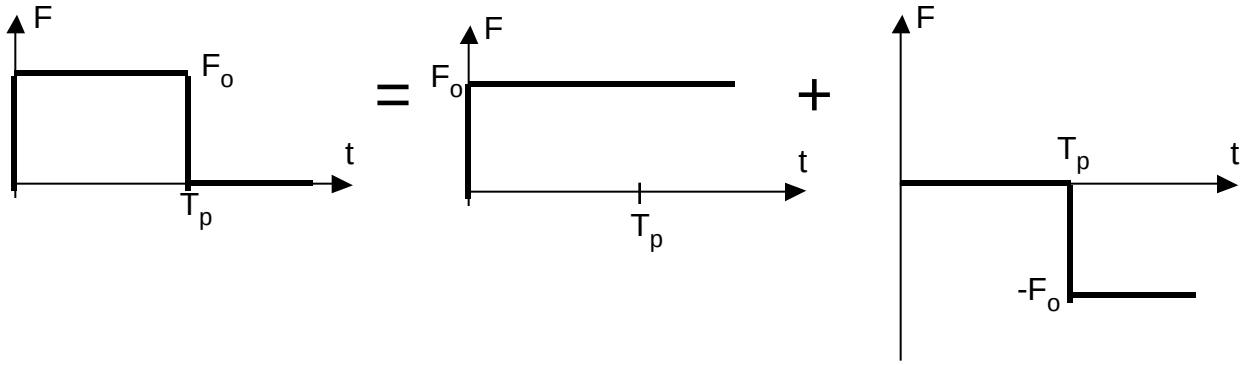
HOME ASSIGNMENT #11

Practice Problems

1. A single spring-mass system (mass of m and spring constant of k) is subjected to a rectangular pulse of duration T_p and magnitude F_o.

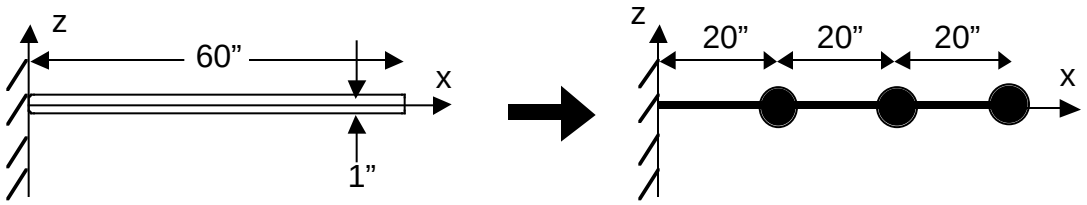


(a) Determine an analytical expression for the response of the system. (HINT: Model the rectangular pulse as the superposition of two step functions.)

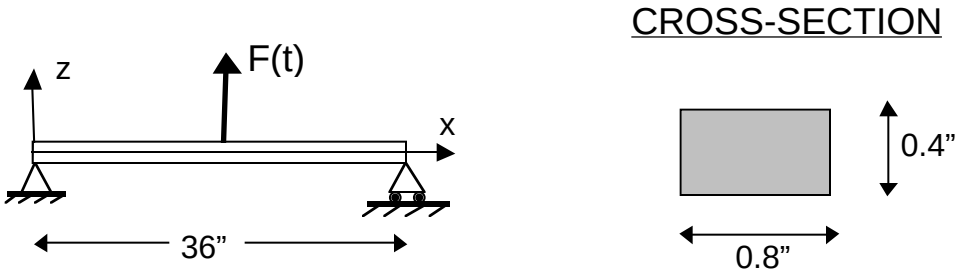


(b) Determine and plot the response for various ratios of the pulse duration to the natural frequency of the system [e.g. $T_p/(2\pi/\omega) = 0.1, 0.2, 0.5, 1, 2, 5, 10$]. Comment on the results.

2. A cantilevered aluminum beam (E = 10.0 Msi, ρ = 0.1 lbs/in^3) has a square cross-section with 1-inch sides and is a total of 60 inches long. Represent this as a three-mass system and determine the natural frequencies and associated mode shapes.



3. A simply-supported aluminum beam (E = 10.0 Msi, ρ = 0.1 lbs/in^3) has a rectangular cross section of 0.4 inches by 0.8 inches and is 36 inches long. The beam has a force [F(t) = (5.0 lbs) sin Ωt] applied at its center.



(a) Determine the natural frequencies and the mode shapes for the first three modes.

(b) Write out the normal equations of motion using the first three modes.

(c) Using these modes, determine the general center deflection of the beam as well as the contribution of each mode to this overall response.

(d) Plot the individual modal amplitude and the total amplitude versus forcing frequency Ω.