MECH 463: Assignment 5

Requires course text book: MECHANICAL VIBRATIONS BY S.S. RAO (4TH EDITION). Solutions will appear approximately ten days after the assignment is posted on VISTA.

Q1. (T4.15, 4th Edition) Sandblasting is a process in which an abrasive material, entrained in a jet, is directed onto a surface of a casting to clean its surface. In a particular setup for sandblasting, the casting mass m is placed on a flexible support of stiffness k as shown below. If the force exerted on the casting due to the sandblasting operation varies as shown below, find the response of the casting.
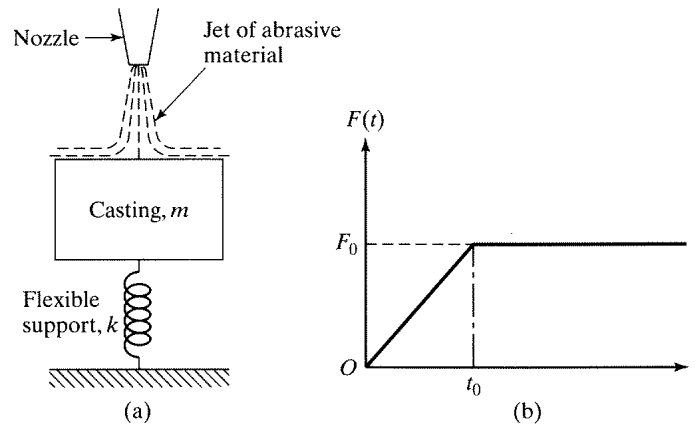

Figure A5.1: Figure for Question 1.

Note: Use both convolution integral technique first and then the principle of superposition to solve this problem. Both methods should give the same solution.

Answer:

$x(t) = \frac{F_0}{k} \left[\frac{t}{t_0} - \frac{\sin \omega_n t}{\omega_n t_0} \right]$ for $0 \leq t \leq t_0$

$x(t) = \frac{F_0}{k} \left[1 + \frac{\sin(\omega_n(t-t_0)) - \sin \omega_n t}{t_0 \omega_n} \right]$ for $t \geq t_0$;

Notice that at $t = t_0$ we have the same solution: $x(t_0) = \frac{F_0}{k} \left[1 - \frac{\sin \omega_n t_0}{\omega_n t_0} \right]$ from both of the above solutions, valid for different time intevals.