4.16 Sandblasting is a process in which an abrasive material, entrained in a jet, is directed onto the surface of a casting to clean its surface. In a particular setup for sandblasting, the casting of mass m is placed on a flexible support of stiffness k as shown in Fig. 4.44(a). If the force exerted on the casting due to the sandblasting operation varies as shown in Fig. 4.44(b), find the response of the casting.

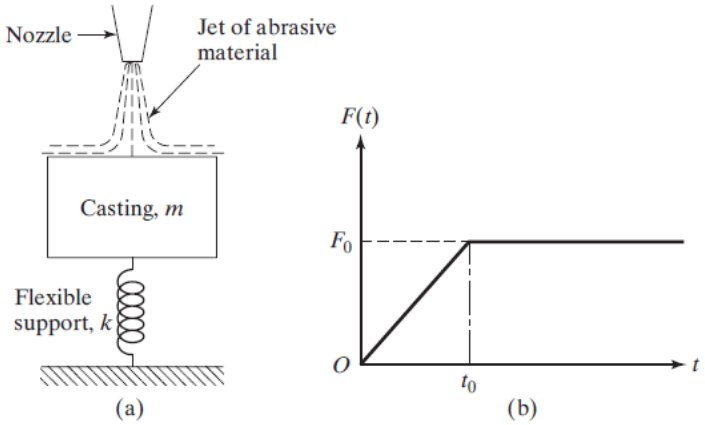

FIGURE 4.44

4.18 A compressed air cylinder is connected to the spring-mass system shown in Fig. 4.45(a). Due to a small leak in the valve, the pressure on the piston, $p(t)$, builds up as indicated in Fig. 4.45(b). Find the response of the piston for the following data: $m = 10$ kg, $k = 1000$ N/m, and $d = 0.1$ m.

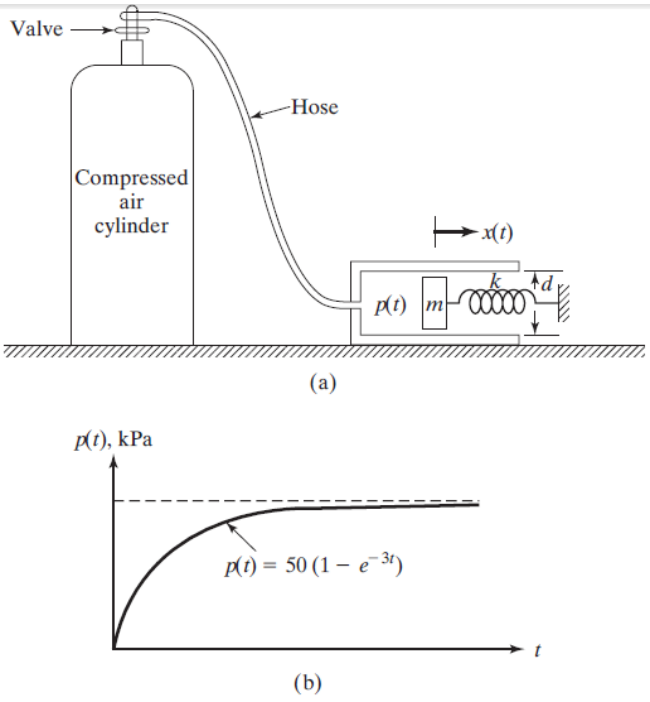

FIGURE 4.45

4.32 Find the response of the rigid bar shown in Fig. 4.53 using convolution integral for the following data: $k_1 = k_2 = 5000$ N/m, $a = 0.25$ m, $b = 0.5$ m, $l = 1.0$ m, $M = 50$ kg, $m = 10$ kg, $F_0 = 500$ N.

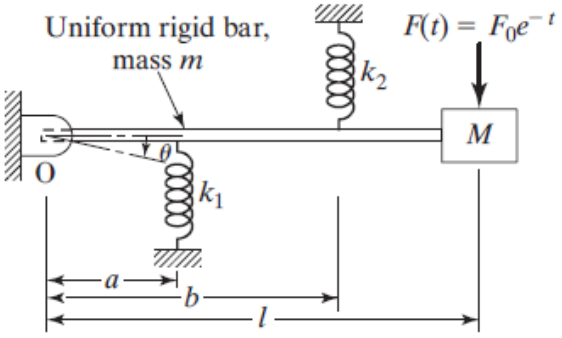

FIGURE 4.53

4.19 Find the transient response of an undamped spring-mass system for $t > \pi/\omega$ when the mass is subjected to a force

$$F(t) = \begin{cases} \dfrac{F_0}{2}(1 - \cos \omega t) & \text{for } 0 \le t \le \dfrac{\pi}{\omega} \\ F_0 & \text{for } t > \dfrac{\pi}{\omega} \end{cases}$$

Assume that the displacement and velocity of the mass are zero at $t = 0$.

4.20–4.22 Use the Dahamel integral method to derive expressions for the response of an undamped system subjected to the forcing functions shown in Figs. 4.46(a) to (c).