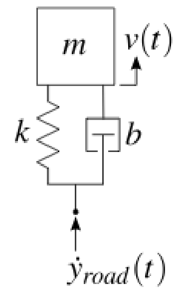
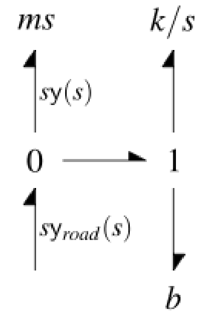
Example 8.1

Find the steady-state response to a sinusoidal input displacement of the form $y_{road} = (A \sin \omega t)\ m/s$ where A=0.03 m and ω=10 rad/s. The system parameters for m, b, and k are 500 kg, 8000 N-s/m, and 34,000 N/m, respectively. The transfer function is given below.

$$\frac{y(s)}{y_{road}(s)} = G(s) = \frac{bs + k}{ms^2 + bs + k}$$



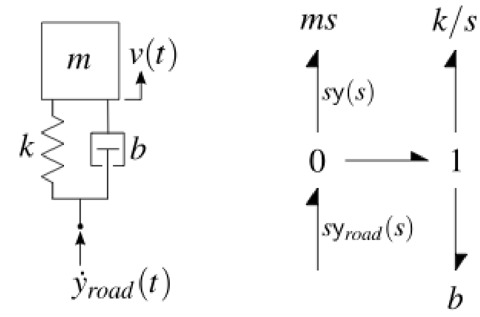
(a)



(b)

Solve the previous problem using MATLAB. The transfer function and system diagram are given.

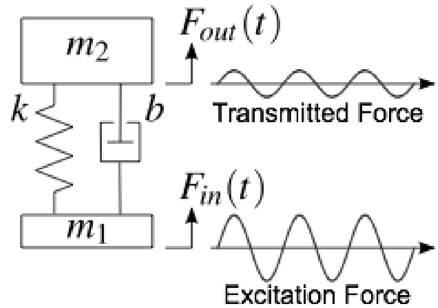
$$\frac{y(s)}{y_{road}(s)} = G(s) = \frac{bs + k}{ms^2 + bs + k}$$



(a) (b)

Example 8.3

Find the transmissibility if the foundation is forced by an excitation $F_{in}(t) = (5sin2t)N$. The first mass, damping constant, spring stiffness, and second mass are 2 kg, 2 N-s/m, 5 N/m, and 1 kg, respectively.

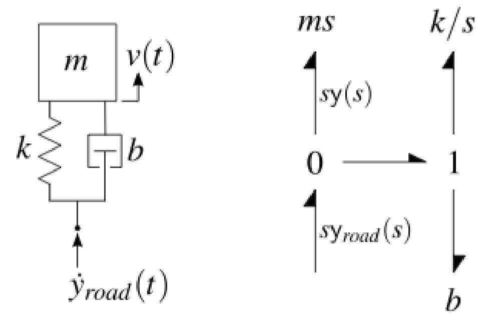


(a)

Example 8.1: Motion Transmissibility

Determine the motion transmissibility from the system depicted in Example 8.1

$$\frac{y(s)}{y_{road}(s)} = G(s) = \frac{bs + k}{ms^2 + bs + k}$$

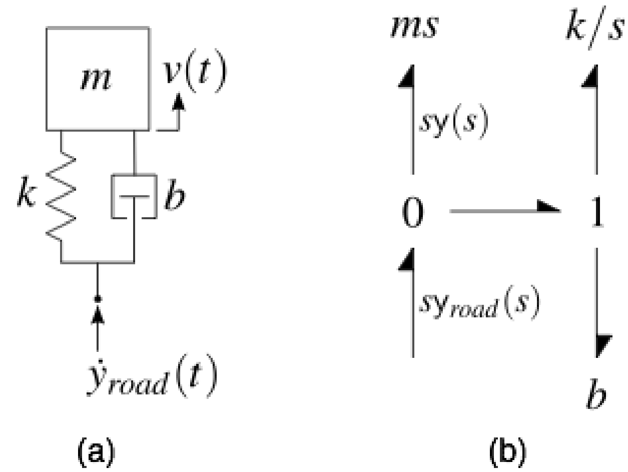


(a) (b)

The Quarter-Car Suspension

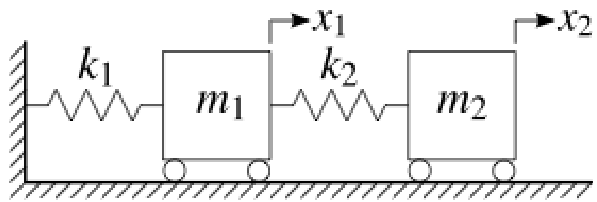
Rewrite the motion transmissibility in terms of the damping ratio and normalized frequency.

$$TR = \frac{\sqrt{k^2 + (b\omega)^2}}{\sqrt{(k - m\omega^2)^2 + (b\omega)^2}}$$

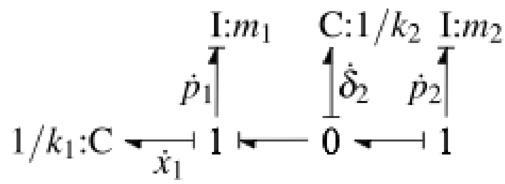


Example 8.4

Find the natural frequencies of vibration and the respective mode shapes for the two DOF structure model and an axially vibrating beam where $k_1 = 2k_2$ *and* $m_1 = 2m_2$. For simplicity, $k_2 = k$ *and* $m_2 = m$.



(a)



(b)