

Check Answer!

19. For the translational mechanical system of [Figure P2.7](#), find the transfer function, $X_1(s)/F(s)$. [[Section: 2.5](#)]

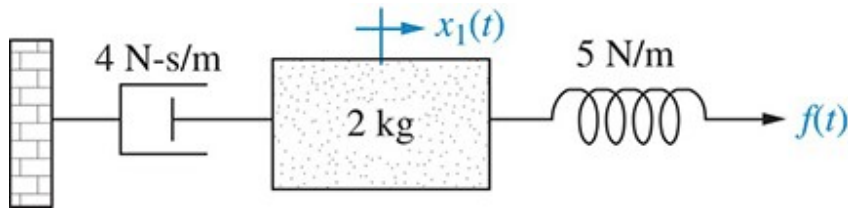


FIGURE P2.7

SS 20. Find the transfer function, $G(s) = X_2(s)/F(s)$, for the translational mechanical network shown in [Figure P2.8](#). [[Section: 2.5](#)]

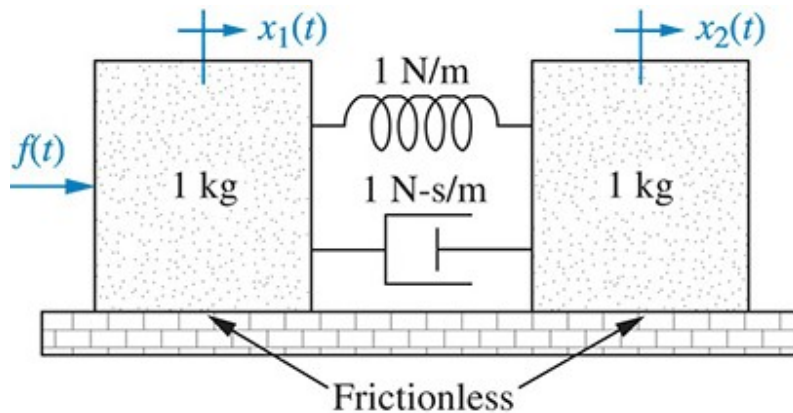


FIGURE P2.8

Check Answer!

21. Find the transfer function, $G(s) = X_2(s)/F(s)$, for the system shown in [Figure P2.9](#). [[Section: 2.5](#)]

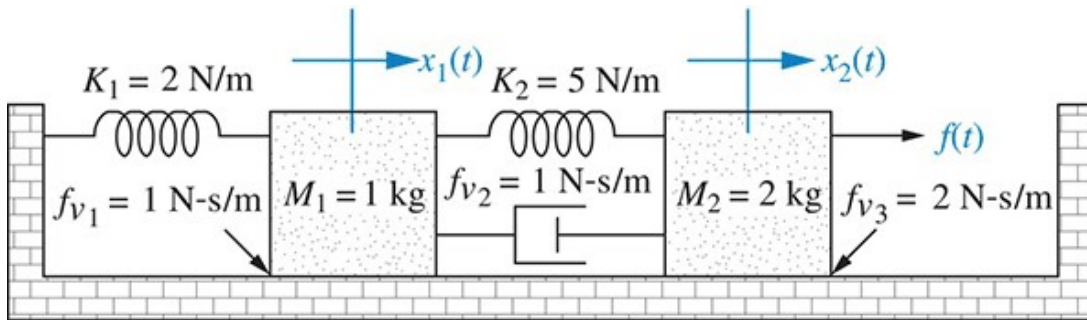


FIGURE P2.9

22. Find the transfer function, $X_3(s)/F(s)$, for each system shown in [Figure P2.10](#). [[Section: 2.5](#)]

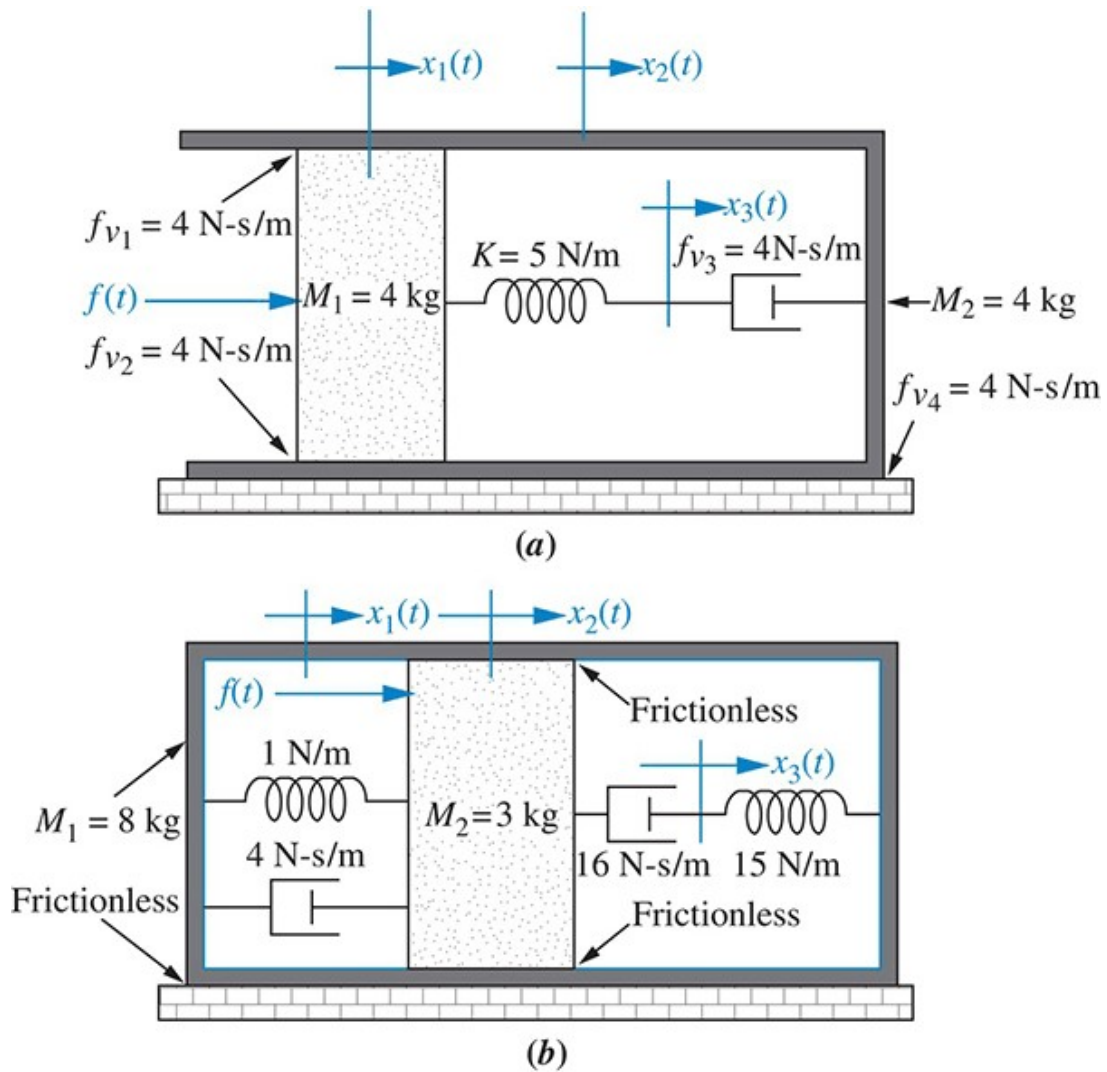


FIGURE P2.10

23. Write, but do not solve, the equations of motion for the translational mechanical system shown in [Figure P2.11](#). [[Section: 2.5](#)]

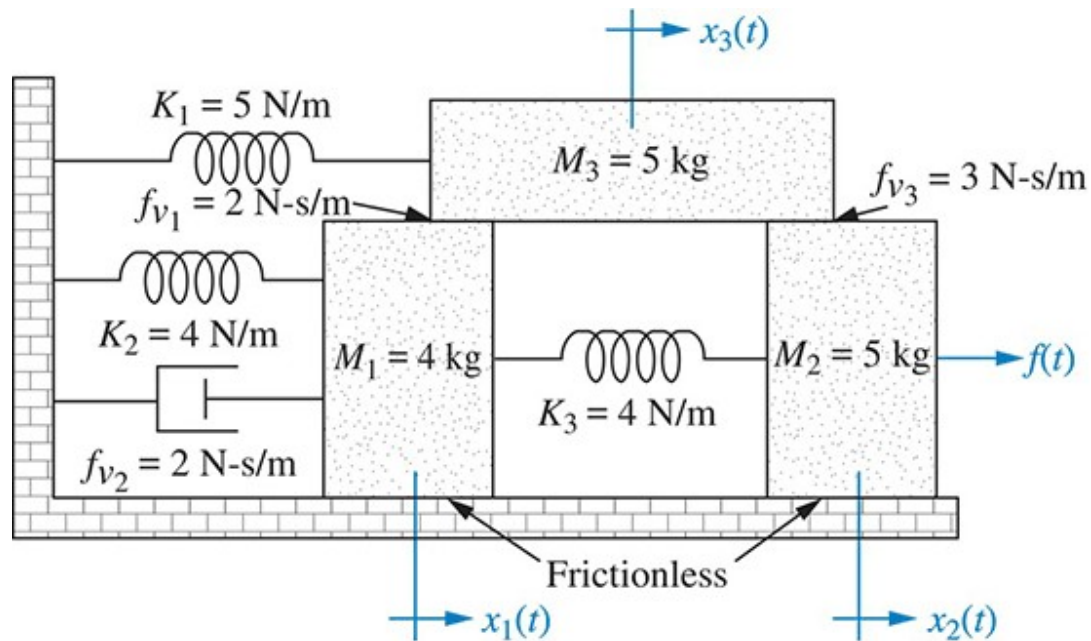


FIGURE P2.11

24. For the unexcited (no external force applied) system of [Figure P2.12](#), do the following:

- Write the differential equation that describes the system.
- Assuming initial conditions $x(0) = x_0$ and $\dot{x}(0) = x_1$, write a Laplace transform expression for $X(s)$.
- Find $x(t)$ by obtaining the inverse Laplace transform from the result in Part **c**.
- What will be the oscillation frequency in Hz for this system?

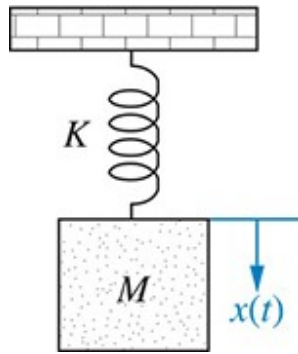


FIGURE P2.12

25. For each of the rotational mechanical systems shown in [Figure P2.13](#), write, but do not solve, the equations of motion. [[Section: 2.6](#)]

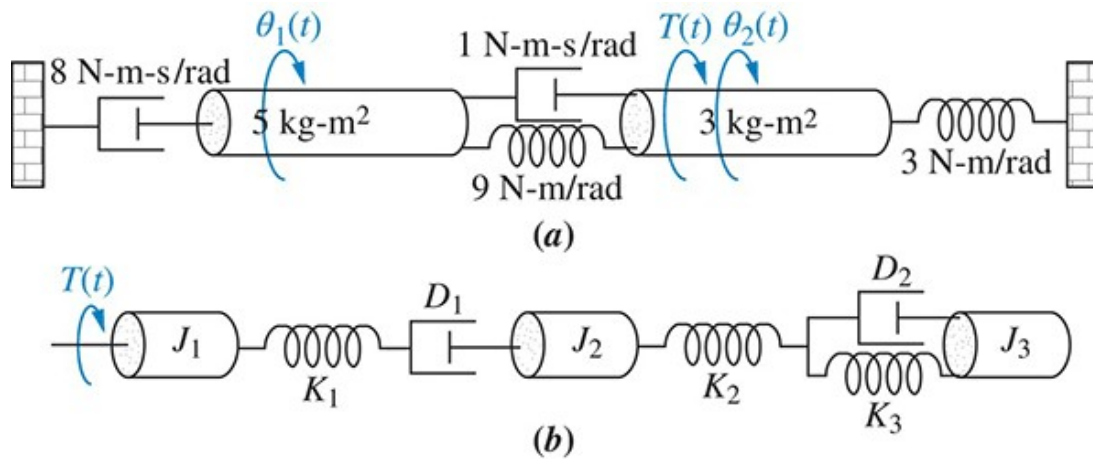


FIGURE P2.13

26. Calculate the transfer function $G(s) = \theta_2(s)/T(s)$ for the system of [Figure P2.14](#). [[Section: 2.6](#)]

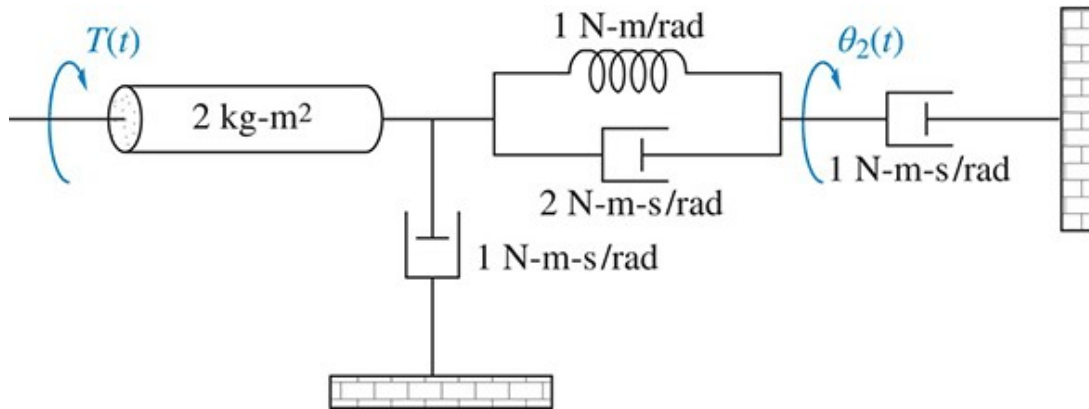


FIGURE P2.14

27. For the rotational mechanical system with gears shown in [Figure P2.15](#), find the transfer function, $G(s) = \theta_3(s)/T(s)$. The gears have inertia and bearing friction as shown. [[Section: 2.7](#)]

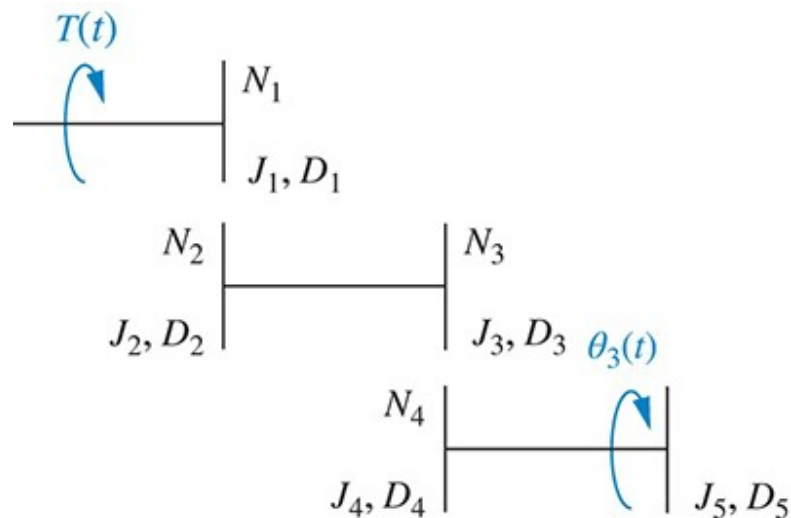


FIGURE P2.15

SS 28. For the rotational system shown in [Figure P2.16](#), find the transfer function, $G(s) = \theta_2(s)/T(s)$. [[Section: 2.7](#)]

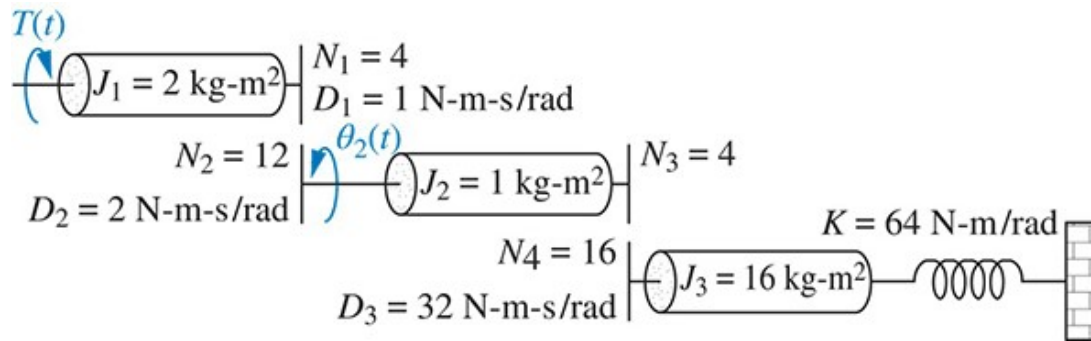


FIGURE P2.16

Check Answer!

29. Obtain the transfer function, $G(s) = \theta_2(s)/T(s)$, for the system of [Figure P2.17](#). [[Section: 2.7](#)]

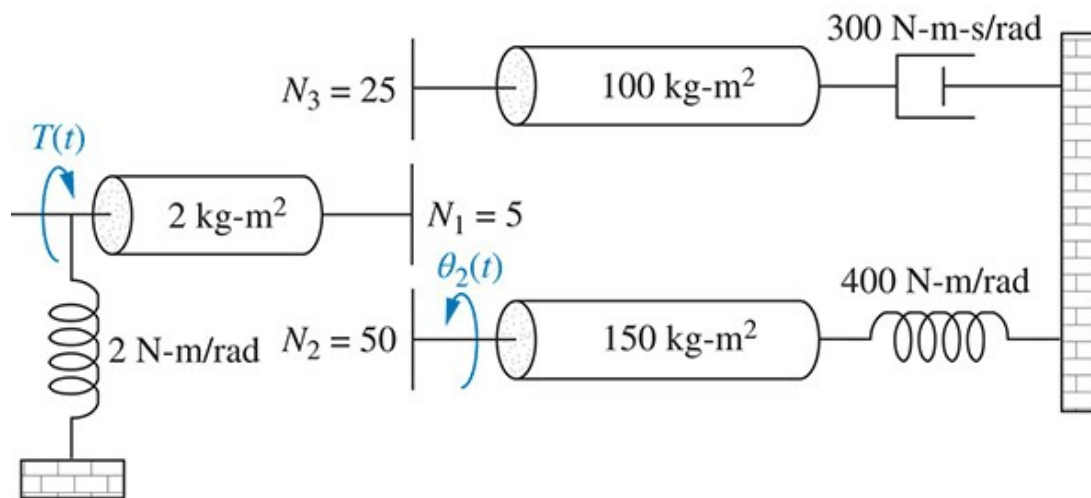


FIGURE P2.17

30. For the rotational system of [Figure P2.18](#), find the transfer function, $G(s) = \theta_2(s)/T(s)$. [[Section: 2.7](#)]



FIGURE P2.19.

The diagram illustrates a mechanical system with three degrees of freedom. It features three rotating masses, J_1 , J_5 , and J_6 , connected by springs K_1 and K_2 , and dampers D . The input is a torque $T_1(t)$ applied to J_1 . The output is the angular displacement $\theta_6(t)$ of J_6 . The system is shown in a side view with various components labeled.

FIGURE P2.20