Chapter 2

Modeling in the frequency domain

Suggested problems

CONTROL SYSTEMS ENGINEERING

Sixth Edition, Norman S. Nise

8. For each of the following transfer functions, write the corresponding differential equation. [Section: 2.3]

a. $\dfrac{X(s)}{F(s)} = \dfrac{7}{s^2 + 5s + 10}$

b. $\dfrac{X(s)}{F(s)} = \dfrac{15}{(s + 10)(s + 11)}$

c. $\dfrac{X(s)}{F(s)} = \dfrac{s + 3}{s^3 + 11s^2 + 12s + 18}$

17. Find the transfer function, $G(s) = V_L(s)/V(s)$, for each network shown in Figure P2.4. [Section: 2.4]

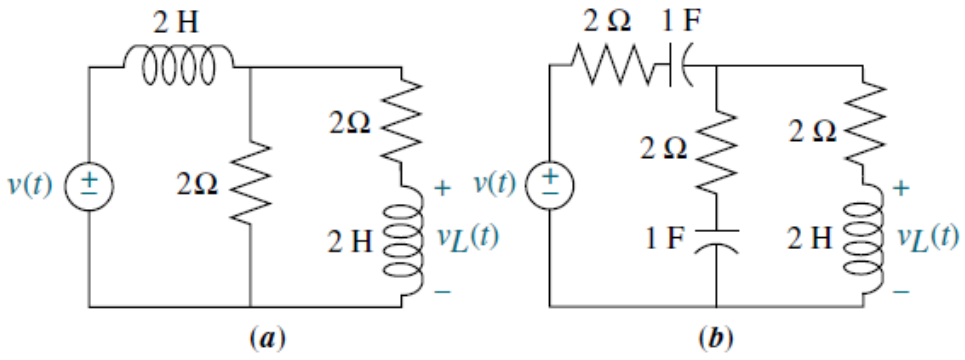

FIGURE P2.4

18. Find the transfer function, $G(s) = V_o(s)/V_i(s)$, for each network shown in Figure P2.5. Solve the problem using mesh analysis. [Section: 2.4]

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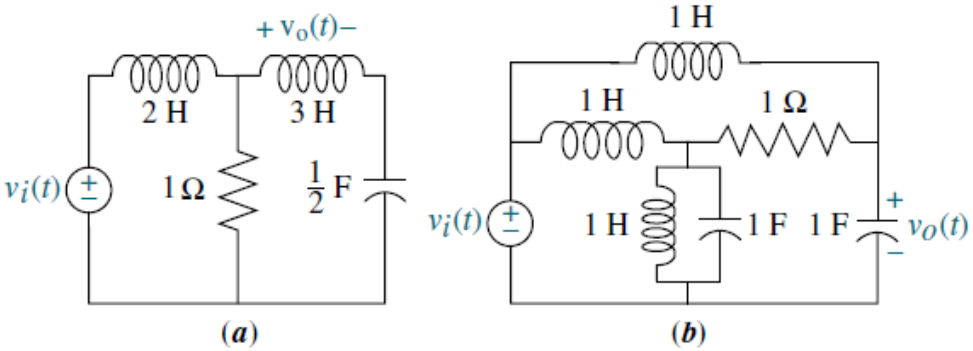

FIGURE P2.5

25. Find the transfer function, $G(s) = X_2(s)/F(s)$, for the translational mechanical system shown in Figure P2.11. (Hint: place a zero mass at $x_2(t)$.) [Section: 2.5]

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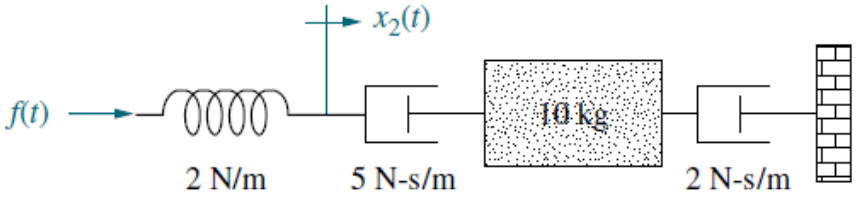

FIGURE P2.11

29. Write, but do not solve, the equations of motion for the translational mechanical system shown in Figure P2.15. [Section: 2.5]

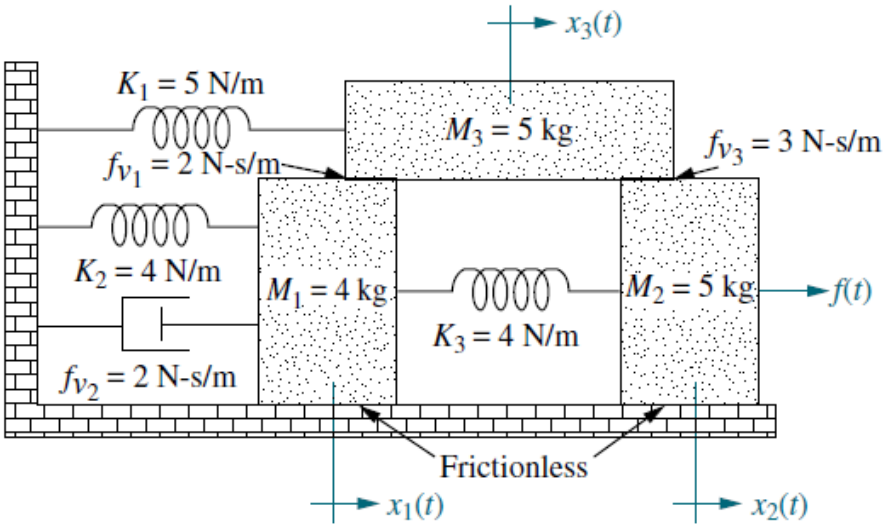

FIGURE P2.15

30. For each of the rotational mechanical systems shown in Figure P2.16, write, but do not solve, the equations of motion. [Section: 2.6]

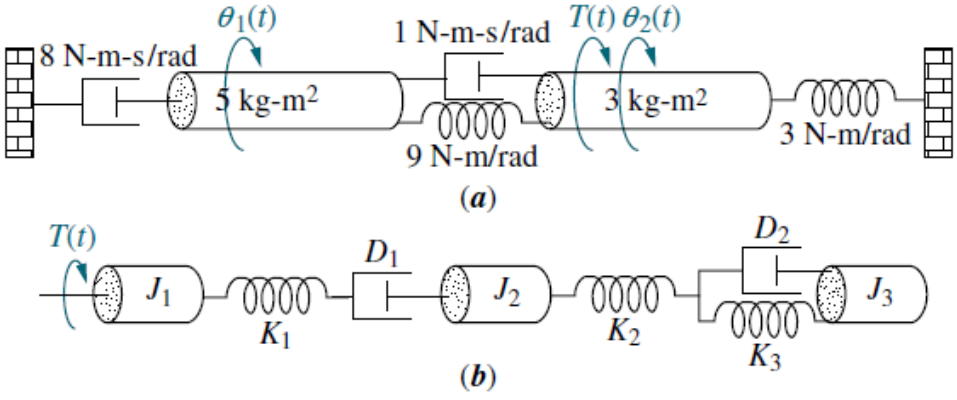

FIGURE P2.16

35. Find the transfer function, $G(s) = \theta_4(s)/T(s)$, for the rotational system shown in Figure P2.21. [Section: 2.7]

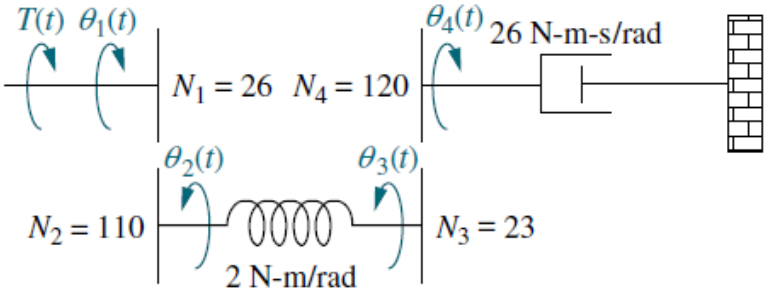

FIGURE P2.21

37. For the rotational system shown in Figure P2.23, write the equations of motion from which the transfer function, $G(s) = \theta_1(s)/T(s)$, can be found. [Section: 2.7]

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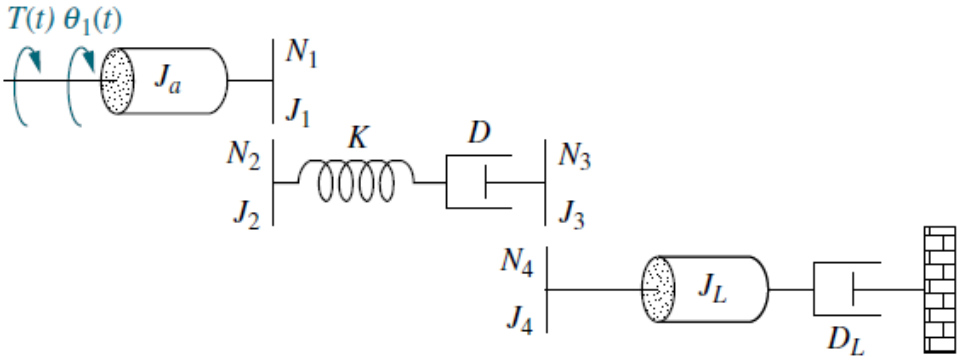

FIGURE P2.23

43. The motor whose torque-speed characteristics are shown in Figure P2.29 drives the load shown in the diagram. Some of the gears have inertia. Find the transfer function, $G(s) = \theta_2(s)/E_a(s)$. [Section: 2.8]

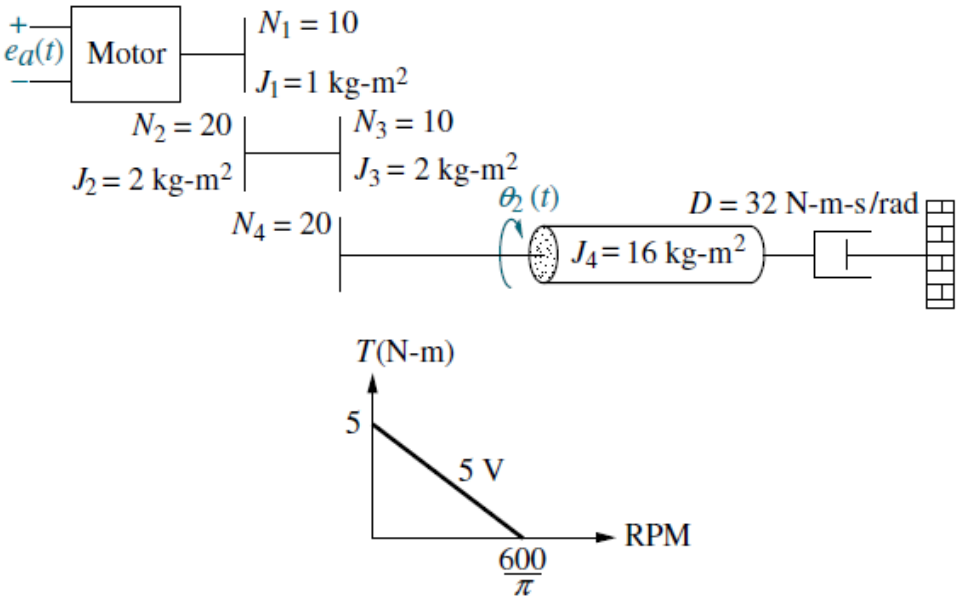

FIGURE P2.29