28. For the rotational mechanical system shown in Figure P2.17. write. but do not solve. the equations of motion.
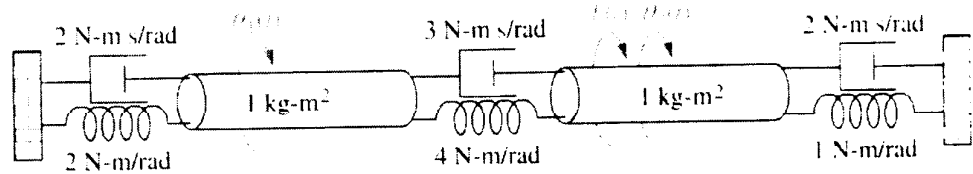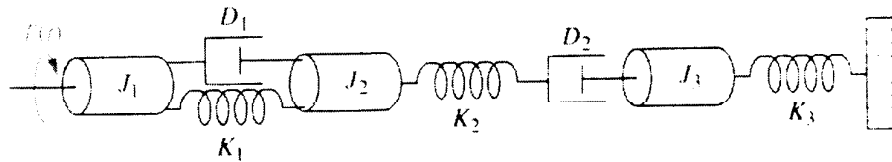
Figure P2.17

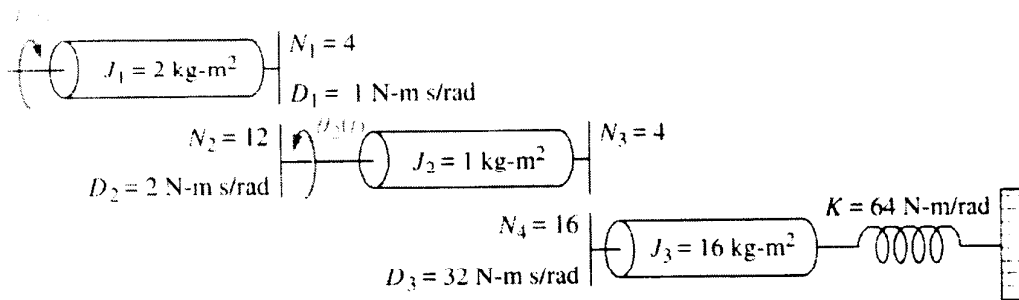2 N-m s/rad   3 N-m s/rad   2 N-m s/rad

1 kg-m^2 1 kg-m^2

2 N-m/rad   4 N-m/rad   1 N-m/rad

29. Write the equations of motion for the rotational mechanical system shown in Figure P2.18.

Figure P2.18

D_1 D_2

J_1 J_2 J_3

K_1 K_2 K_3

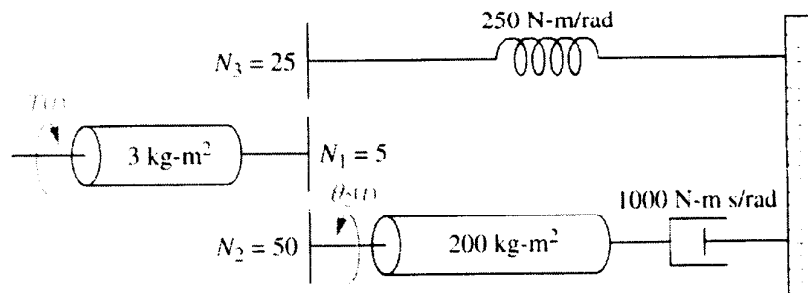**31.** For the rotational system shown in Figure P2.20. find the transfer function. $G(s) = \theta_2(s)/T(s)$.

Figure P2.20

$J_1 = 2$ kg-m^2 $N_1 = 4$

$D_1 = 1$ N-m s/rad

$N_2 = 12$ $J_2 = 1$ kg-m^2 $N_3 = 4$

$D_2 = 2$ N-m s/rad

$N_4 = 16$ $J_3 = 16$ kg-m^2 $K = 64$ N-m/rad

$D_3 = 32$ N-m s/rad

32. Find the transfer function. $G(s) = \theta_2(s)/T(s)$. for the rotational mechanical system shown in Figure P2.21.

Figure P2.21

$N_3 = 25$ 250 N-m/rad

3 kg-m^2 $N_1 = 5$

1000 N-m s/rad

$N_2 = 50$ 200 kg-m^2

33. Find the transfer function, $G(s) = \theta_4(s)/T(s)$. for the rotational system shown in Figure P2.22.

Figure P2.22

$N_1 = 25$ $N_4 = 100$ 25 N-m s/rad

$N_2 = 100$ 1 N-m/rad $N_3 = 20$