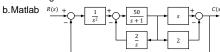
System Dynamics and Control

Reduction of Multiple Subsystems - Problems

5.1 Reduce the block diagram to a single TF, T(s) = C(s)/R(s). Use the following methods

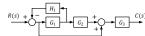
a. Block diagram reduction



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5.2 Find the equivalent TF, T(s) = C(s)/R(s) for the system using block diagram reduction TF



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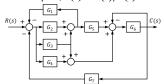
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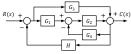
**5.3** Find the closed-loop TF, T(s) = C(s)/R(s) for the system



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**5.4** Reduce the system to a single TF T(s) = C(s)/R(s)



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5.11 For the given system, find the percent overshoot, settling time, and peak time for a step input if the system's response is underdamped. (Is it? Why?)



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5.12 For the given system, find the output c(t) if the input r(t) is a unit step r(t) = r(t)

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5.14 For the given system, find the value of  $\it K$  that yields 10% overshoot for a step input



5.15 For the given system, find  $\it K$  and a to yield a settling time of  $0.15\it s$  and a 30% overshoot



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Reduction of Multiple Subsystems - Problems

**5.31** Represent the systems below in state space in phase-variable form. Draw the signal-flow graphs

a. 
$$G(s) = \frac{s+3}{s^2 + 2s + 7}$$
  
b.  $G(s) = \frac{s^2 + 2s + 6}{3s^3 + 5s^2 + 2s + 1}$   
c.  $G(s) = \frac{s^3 + 2s^2 + 7s + 1}{s^4 + 3s^3 + 5s^2 + 6s + 4}$ 

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10 Reduction of Multiple Subsystems - Problems

5.34 You are given the system shown in the figure

$$(s) + E(s) \over s(s+1)(s+2)$$

$$C(s)$$

- a. Represent the system in state space in phase variable form
- b. Represent the system in state space in any other form besides phase-variable

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11 Reduction of Multiple Subsystems - Problems

5.39 Given a unity feedback system with the forward-path TF

$$G(s) = \frac{7}{s(s+9)(s+12)}$$

use matlab to represent the closed loop system in state space in a.phase-variable form

b.parallel form

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12 Reduction of Multiple Subsystems - Problems

5.45 Diagonalize the following system

$$\dot{\mathbf{x}} = \begin{bmatrix} -5 & -5 & 4 \\ 2 & 0 & -2 \\ 0 & -2 & -1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} -1 \\ 2 \\ -2 \end{bmatrix} r, y = \begin{bmatrix} -1 & 1 & 2 \end{bmatrix} \mathbf{x}$$

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