O K L A H O M A S T A T E U N I V E R S I T Y

S C H O O L O F E L E C T R I C A L A N D C O M P U T E R E N G I N E E R I N G
S C H O O L O F M E C H A N I C A L A N D A E R O S P A C E E N G I N E E R I N G

ECEN 4413/MAE 4053
Automatic Control Systems
Spring 2008

Midterm Exam #1

Choose any four out of five problems.
Please specify which four listed below to be graded:
1)_____; 2)_____; 3)_____; 4)_____;

Name : _____

Student ID: _____

E-Mail Address:_____

Problem 1:

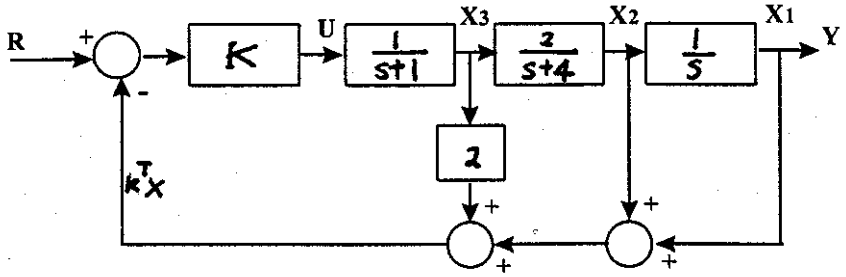
Given a system described by the transfer function

$$H(s) = \frac{Y(s)}{X(s)} = \frac{-5s + 6}{s^2 + 4s + 13}$$

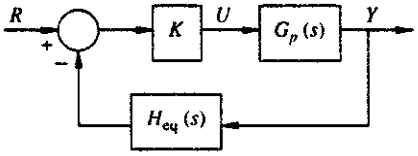
with initial conditions and input: $y(0) = 3$, $\left.\frac{dy(t)}{dt}\right|_{t=0} = -2$, $x(t) = e^{-4t}u(t)$, where $y(t)$ is the output response and $x(t)$ is the input signal. Find $y(t)$ and steady-state output via final value theorem.

Problem 2:

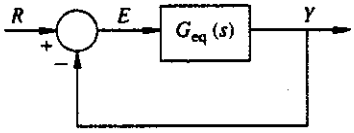
Using *block diagram reduction technique* to rearrange the following block diagram into the equivalent *H* and *G* configurations of the feedback control system shown below.



H Configuration

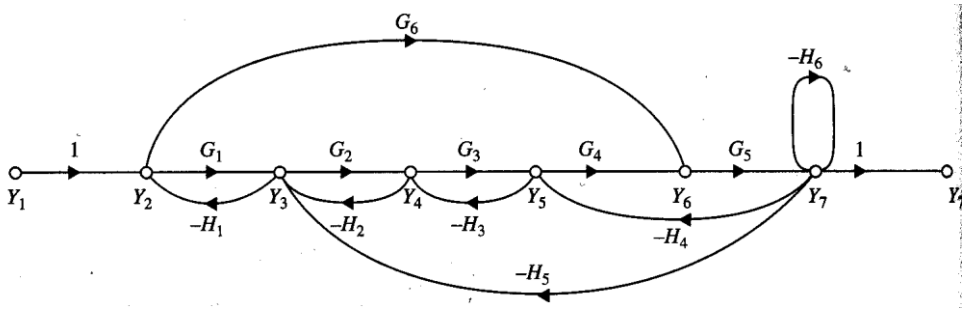


G Configuration



Problem 3:

Find the transfer functions Y_7 / Y_1 and Y_2 / Y_1 of the SFG shown below.

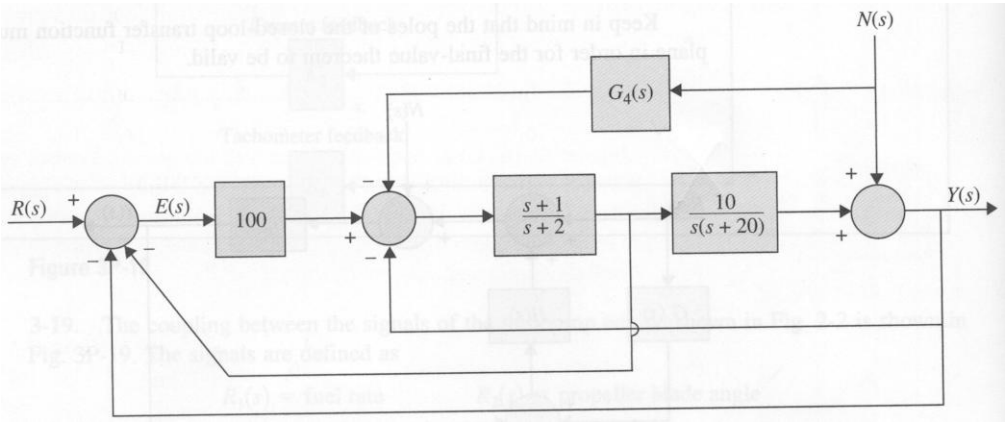


Problem 4:

The block diagram of a feedback control system is shown below.

a) Derive the transfer functions of $\left.\frac{Y(s)}{R(s)}\right|_{N=0}$, $\left.\frac{Y(s)}{N(s)}\right|_{R=0}$.

b) The controller with the transfer function $G_4(s)$ is for the reduction of the effect of the noise $N(s)$. Find $G_4(s)$ so that the output $Y(s)$ is totally independent of $N(s)$.



Problem 5:

Let $\bar{y}(t)$ be the unit-step response of a linear time-invariant system. Show that the impulse response of the system equals to $\frac{d\bar{y}(t)}{dt}$.