ELECTRICAL ENGINEERING DEPARTMENT

EE 550-01 INTRODUCTION TO MODERN CONTROL

Second Semester 2001/2002

Instructor: Dr. Samir AL-Baiyat

HW 2

12/02/2002

Due Date: 4/03/2002

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1. Find the state space representation corresponding to the block diagram in Figure 1. Choose the state variables to be the outputs of the unit delays, $q_1[n]$ and $q_2[n]$, as indicated in the figure.

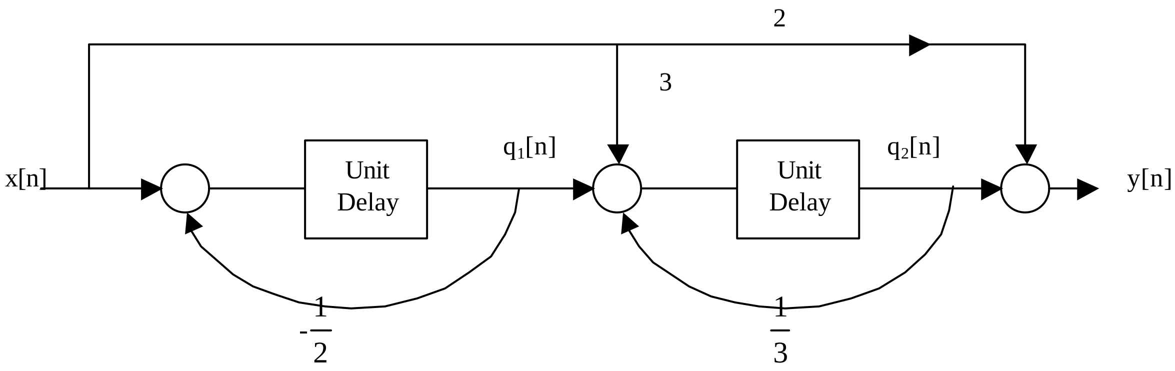

Figure 1

2. Problem 2.20 of Text.
3. For the nonlinear state equation

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} x_2(t) - 2x_2(t)x_1(t) \\ -x_1(t) + x_1^2(t) + x_2^2(t) + u(t) \end{bmatrix}$$

with constant nominal input , compute the possible constant nominal solutions, often called equilibrium states, and the corresponding linearized state equations.

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4. Find the dynamical equation description of the feedback system. Where S_1 and S_2 are, respectively, described by

$$\begin{bmatrix} \dot{x}_{11} \\ \dot{x}_{12} \end{bmatrix} = \begin{bmatrix} -2 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_{11} \\ x_{12} \end{bmatrix} + \begin{bmatrix} 4 & 1 \\ -1 & 2 \end{bmatrix} u_1$$

$$y_1 = \begin{bmatrix} 0 & 1 \end{bmatrix} x_1 + \begin{bmatrix} 1 & -1 \end{bmatrix} u_1$$

and

$$\begin{bmatrix} \dot{x}_{21} \\ \dot{x}_{22} \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix} u_2$$

$$y_2 = \begin{bmatrix} 2 & 0 \\ 1 & -1 \end{bmatrix} x_2$$

5. Find a state space realization for the following transfer function

$$G(s) = \frac{2}{4s^3 + 2s^2 + 4s + 1}$$