بسم ا الر ن الرحيم

ELECTRICAL ENGINEERING DEPARTMENT
EE 550-01 LINEAR CONTROL SYSTEM
Second Semester 2004/2005

HW 2

March 07, 2005
Due Date: March 14, 2005

1. A linear time-invariant multivariable system with inputs $u_1(t)$ and $u_2(t)$ and outputs $y_1(t)$ and $y_2(t)$ is described by the following set of differential equations.

$$\frac{d^2 y_1(t)}{dt^2} + 2\frac{dy_1(t)}{dt} + 3y_2(t) = u_1(t) + u_2(t)$$

$$\frac{d^2 y_2(t)}{dt^2} + 3\frac{dy_1(t)}{dt} + y_1(t) - y_2(t) = u_2(t) + \frac{du_1(t)}{dt}$$

Find system transfer function:

$Y(s) = G(s)\ U(s)$

2. Given the differential equation,

$$\frac{d^3 y(t)}{dt^3} + 5\frac{d^2 y(t)}{dt^2} + \frac{dy(t)}{dt} + 2y(t) = \frac{du(t)}{dt} + 2u(t)$$

find the state space representation for the system:

3. Do problem 2.18 of text. The part related to Fig. 2.25

4. Define sate variables such that the n^{th} order differential equation

$$y^{(n)}(t) + a_{n-1} t^{-1} y^{(n-1)}(t) + a_{n-2} t^{-2} y^{(n-2)}(t) + \dots\dots\dots + a_1 t^{-n+1} y^{(1)}(t) + a_o t^{-n} y(t) = 0$$

Can be written as a linear state equation

$$\dot{x}(t) = t^{-1} Ax(t)$$

Where A is a constant *n* x *n* matrix.

5. What is the degree of the following transfer function? Find its minimal realization too.

$$g(s) = \frac{s^2 - 1}{s^3 + 3s^2 + 5s + 3}$$