ME 343 – Control Systems

Lecture 35

November 13, 2009

Model Representation

Scalar Differential Equation

$$a_n y^{(n)} + a_{n-1} y^{(n-1)} + \cdots + a_1 \dot{y} + a_0 y = b_m u^{(m)} + b_{m-1} u^{(m-1)} + \cdots + b_1 \dot{u} + b_0 u$$

Transfer Function

$$G(s) = \frac{Y(s)}{U(s)} = \frac{b_m s^m + b_{m-1} s^{m-1} + \cdots + b_1 s + b_0}{a_n s^n + a_{n-1} s^{n-1} + \cdots + a_1 s + a_0}$$

State Variable Representation

$$\dot{x} = Ax + Bu$$
$$y = Cx + Du$$

Transfer Function

$$G(s) = \frac{Y(s)}{U(s)} = C(sI - A)^{-1} B + D$$

Model Representation

Example: $\dddot{y} + 3\ddot{y} + 4\dot{y} + 2y = 2\dot{u} + u$

Find: - State variable representation

Scalar Differential Equation

State Variable Representation

Model Representation

Example: $\dfrac{Y(s)}{U(s)} = \dfrac{s+6}{s^2+5s+6}$

Find: - State variable representation

Transfer function

State Variable Representation