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ILLUSTRATIVE PROBLEMS

Linear, Continuous-Time, Constant Coefficients

3.1 Four input-output transfer functions $y(s)/u(s)$ are given. Describe the syster state variable form:

(a) $1/(s+\alpha)$ **(b)** $(s+\beta)/(s+\alpha)$

(c) $(s+\beta)/(s^2+2\zeta\omega s+\omega^2)$ **(d)** $(s^2+2\zeta_1\omega_1 s+\omega_1^2)/(s^2+$

The solutions are obtained by writing the input-output differential eq simulation diagram, and selecting the integrator outputs as state variables.

(a) The differential equation is $\dot{y}+\alpha y=u$. This is simulated in Figure $\dot{x}=-\alpha x+u$ and $y=x$.

(b) The differential equation is $\dot{y}+\alpha y=\beta u+\dot{u}$. This is simulated in Figure $\dot{x}=-\alpha x+(\beta-\alpha)u$ and $y=x+u$.

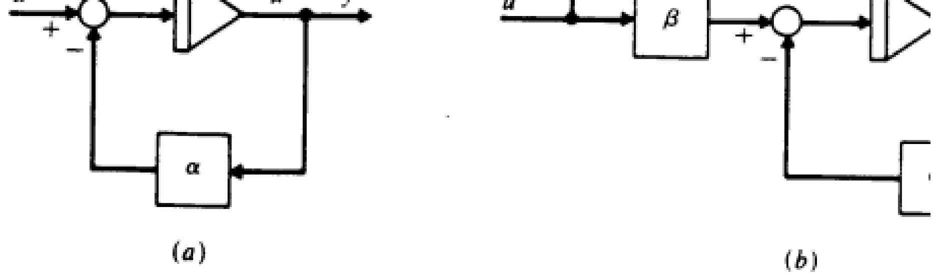

Figure 3.29 (a) and (b)

(c) The differential equation is $\ddot{y} + 2\zeta\omega\dot{y} + \omega^2 y = \beta u + \dot{u}$, and is simulated
state equations are $\dot{x}_1 = -2\zeta\omega x_1 + x_2 + u$, $\dot{x}_2 = -\omega^2 x_1 + \beta u$, and $y = [1$

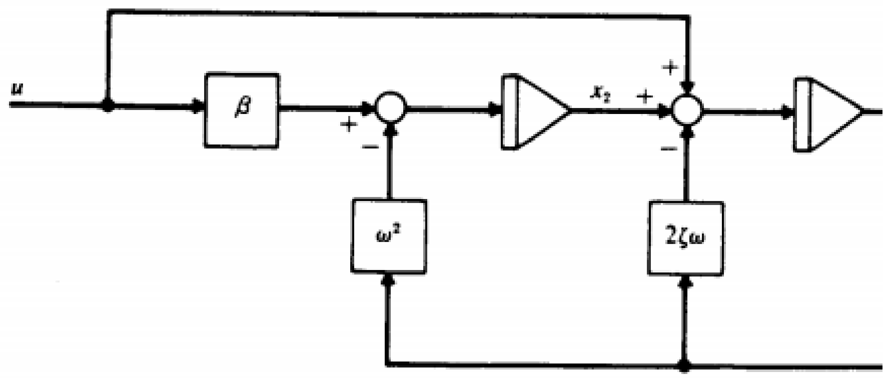

Figure 3.29 (c)