

Homework No. 4

Due 10:10 am, April 11, 2006

1. Determine the homogeneous and particular solutions for the system described by the following differential equation for the given inputs and initial conditions:

$$\frac{d^2}{dt^2} y(t) + 2 \frac{d}{dt} y(t) + y(t) = \frac{d}{dt} x(t), \quad y(0^-) = -1, \quad \left. \frac{d}{dt} y(t) \right|_{t=0^-} = 1$$

(1) $x(t) = 2e^{-t}u(t)$; (2) $x(t) = 2\sin(t)$.

2. Identify the natural and forced responses for the systems described by the following differential equation with input and initial conditions as specified:

$$\frac{d^2}{dt^2} y(t) + y(t) = 3 \frac{d}{dt} x(t), \quad y(0^-) = -1, \quad \left. \frac{d}{dt} y(t) \right|_{t=0^-} = 1, \quad x(t) = 2te^{-t}u(t)$$

3. Determine the homogeneous and particular solutions for the system described by the following difference equation for the given inputs and initial conditions:

$$y[n] + y[n-1] + \frac{1}{4}y[n-2] = x[n] + 2x[n-1], \quad y[-1] = 1, \quad y[-2] = 0$$

(1) $x[n] = u[n]$; (2) $x[n] = \left(-\frac{1}{4}\right)^n u[n]$.

4. Identify the natural and forced responses for the systems described by the following difference equation with input and initial conditions as specified:

$$y[n] - \frac{1}{2}y[n-1] = 2x[n], \quad y[-1] = 3, \quad x[n] = \left(\frac{-1}{2}\right)^n u[n]$$

5.

- (1) Draw the direct form I and direct form II implementations for the following difference and differential equations:

(a) $y[n] + \frac{1}{2}y[n-1] - y[n-3] = 3x[n-1] + 2x[n-2]$.

(b) $\frac{d^3}{dt^3} y(t) + 2 \frac{d}{dt} y(t) + 3y(t) = x(t) + 3 \frac{d}{dt} x(t)$

- (2) Find difference and differential-equation descriptions for the systems depicted in Fig. 1 (a) and (b).

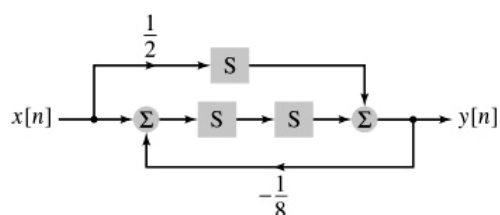
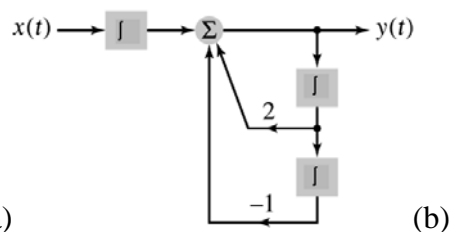


Figure 1 (a)



(b)