

Homework No. 3

Due 10:10 am, 4/10, 2007

1.

Determine a particular solution for the systems described by following differential / difference equations, for the given input

$$(a.) \quad \frac{d^2}{dt^2} y(t) + 2 \frac{d}{dt} y(t) + y(t) = \frac{d}{dt} x(t)$$

$$(1.) x(t) = e^{-3t} u(t)$$

$$(2.) x(t) = 2 \sin(t)$$

$$(b.) \quad y[n] - \frac{2}{5} y[n-1] = 2x[n]$$

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

$$(2.) x[n] = \cos\left(\frac{\pi}{5} n\right)$$

2.

Determine the output of the system described by the following differential / difference equations with input and initial conditions as specified:

$$(a.) \quad \frac{d}{dt} y(t) + 10y(t) = 2x(t)$$

$$y(0^-) = 1, x(t) = u(t)$$

$$(b.) \quad \frac{d^2}{dt^2} y(t) + 6 \frac{d}{dt} y(t) + 8y(t) = 2x(t)$$

$$y(0^-) = -1, \frac{d}{dt} y(t) \Big|_{t=0^-} = 1, x(t) = e^{-t} u(t)$$

$$(c.) \quad y[n] - \frac{1}{9} y[n-2] = x[n-1]$$

$$y[-1] = 1, y[-2] = 0, x[n] = u[n]$$

$$(d.) \quad y[n] + \frac{1}{4} y[n-1] - \frac{1}{8} y[n-2] = x[n] + x[n-1]$$

$$y[-1] = 4, y[-2] = -2, x[n] = (-1)^n u[n]$$

3.

Identify the natural and forced responses for the system as

- (a.)
$$\frac{d^2}{dt^2} y(t) + 5 \frac{d}{dt} y(t) + 4 y(t) = \frac{d}{dt} x(t)$$
$$y(0^-) = 0, \left. \frac{d}{dt} y(t) \right|_{t=0^-} = 1, x(t) = \sin(t)u(t)$$
- (b.)
$$y[n] - \frac{3}{4} y[n-1] + \frac{1}{8} y[n-2] = 2x[n]$$
$$y[-1] = 1, y[-2] = -1, x[n] = 2u[n]$$