

Part I: Time-Domain Methods

1. For a system described by the following differential equation,

$$y'' + 7y' + 6y = x' + 2x$$

where $y(0^-) = 1$ and $y'(0^-) = 1$, using **time-domain** methods only,

- (a) determine the zero-input response, and
 - (b) determine the impulse response.
 - (c) Determine the Lyapunov (Asymptotic/Internal) stability of the associated system.
2. For a system whose impulse response is given by

$$h(t) = (e^{2t} + e^{-2t}) u(t)$$

determine the zero-state response for $x(t) = u(t)$ using convolution.

3. Determine if the system in the previous problem is BIBO stable.
4. Given three systems whose impulse responses are

$$\begin{aligned} h_1(t) &= e^{-3t} u(t) \\ h_2(t) &= e^{-5t} u(t) \\ h_3(t) &= e^{-9t} \cos(3\pi t) u(t) \end{aligned}$$

respectively, determine the overall impulse response if the systems are connected as follows:

