

Exercise 01. Plot the graph of the following function

$$f(t) = \delta_{-1}(t) - (t-2)\delta_{-1}(t-2) + (t-3)\delta_{-1}(t-5).$$

Exercise 02. Consider the following system given in IO representation

$$\dot{y}(t) + y(t) + \alpha = u(t), \quad \alpha \in \mathcal{R}$$

Discuss the linearity and stationarity properties of the systems as a function of the parameter α .

Exercise 03. An IO model has a characteristic polynomial with 3 distinct roots, each of which associates with a stable mode and a time constant that is smaller than 1 [s]. Comment on where in the complex plane these roots are located.

Exercise 04. Consider the following linear time-invariant system in IO representation

$$2\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 2y(t) = u(t)$$

Determine and plot the force-free response from $t_0 = 0$ and the following initial conditions

$$\begin{aligned} y(t) \Big|_{t=t_0} &= 1 \\ \frac{dy(t)}{dt} \Big|_{t=t_0} &= 1 \end{aligned} .$$