



Example 9-8: Integrator is Linear

The integrator system is a linear system. To show this, note that if $x(t) = \alpha x_1(t) + \beta x_2(t)$, the corresponding output is

$$\begin{aligned} y(t) &= \int_{-\infty}^t x(\tau) d\tau = \int_{-\infty}^t [\alpha x_1(\tau) + \beta x_2(\tau)] d\tau \\ &= \alpha \int_{-\infty}^t x_1(\tau) d\tau + \beta \int_{-\infty}^t x_2(\tau) d\tau \\ &= \alpha y_1(t) + \beta y_2(t) \end{aligned}$$

Thus, the integrator system is a linear system. ■