Example 9-7: Squaring is Nonlinear

The squaring system is *not* a linear system, i.e., it is a *nonlinear* system. To see this, note that if $x(t) = \alpha x_1(t) + \beta x_2(t)$, the corresponding output is

$$y(t) = [\alpha x_1(t) + \beta x_2(t)]^2$$

and after some algebra we obtain

$$y(t) = \alpha^2[x_1(t)]^2 + 2\alpha\beta x_1(t)x_2(t) + \beta^2[x_2(t)]^2$$

$$\neq \alpha y_1(t) + \beta y_2(t)$$

where $y_1(t) = [x_1(t)]^2$ and $y_2(t) = [x_2(t)]^2$. Therefore, the squaring system is nonlinear. ■