

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.

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