

Problem 6.1: Determine if the discrete-time systems specified by the following input-output relationships are linear. Assume the input is $x[n]$ and output is $y[n]$. If not, provide a counterexample.

- (a) $y[n] = x[3n]$
- (b) $y[n] = (n + 1)x[n]$

Problem 6.2: Determine if the continuous-time systems specified by the following input-output relationships are linear. Assume the input is $x(t)$ and output is $y(t)$. If not, provide a counterexample.

- (a) $y(t) = 2x(t) + 3$
- (b) $y(t) = x(-t)$

Problem 6.3: Are the discrete-time systems described in Problem 6.1 time-invariant? If not, provide a counterexample.

Problem 6.4: Are the continuous-time systems described in Problem 6.2 time-invariant? If not, provide a counterexample.

Problem 6.5: You have a circuit and want to determine whether or not it possesses some system properties, so you conduct an experiment in which you apply three separate ac voltages at the input and record their corresponding ac voltages resulting at the output. The results of your experiment are shown in Figure 1. Citing specifics from the experiment, explain how you can tell the circuit is not

- (a) linear
- (b) time-invariant

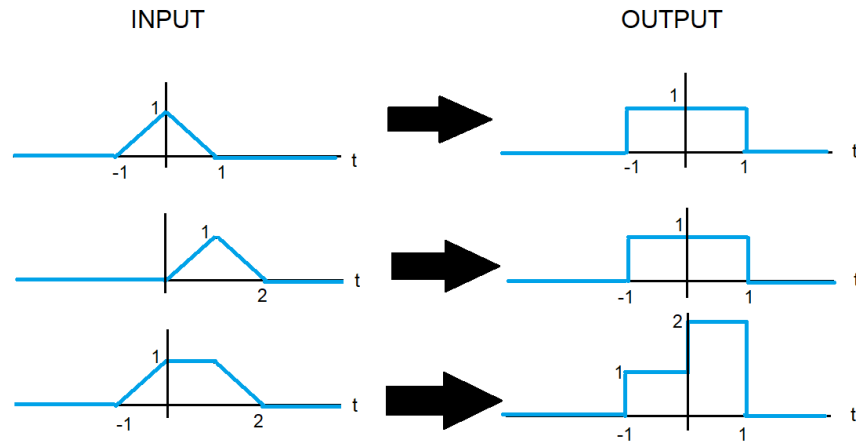


Figure 1

Optional, but testable, problems: From the textbook, Problems 1.18 (a,b), 1.27 (linearity and time-invariance), 1.28 (linearity and time-invariance).