

Tutorial 2

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- 1.20) a continuous-time linear system S with input $x(t)$ and output $y(t)$ yields the following input-output pairs:

$$x(t) = e^{j2t} \xrightarrow{S} y(t) = e^{j3t},$$

$$x(t) = e^{-j2t} \xrightarrow{S} y(t) = e^{-j3t},$$

- If $x(t) = \cos(2(t-1/2))$, determine the corresponding output $y(t)$ for the system S .

- 1.25,1.26) Determine whether or not each of the following signals is periodic if the signal is periodic. Determine its fundamental period.

$$a) x(t) = 3 \cos(4t + \pi / 3)$$

$$a) x(t) = \cos\left(\frac{\pi}{8} n^2\right)$$

$$b) x(t) = [\cos(2t - \pi / 3)]^2$$

$$b) x(t) = \cos\left(\frac{\pi}{2} n\right) \cos\left(\frac{\pi}{4} n\right)$$

$$c) x(t) = ev \left\{ \cos(4\pi t) u(t) \right\}$$

$$c) x(t) = 2 \cos\left(\frac{\pi}{4} n\right) + \cos\left(\frac{\pi}{8} n\right) - 2 \cos\left(\frac{\pi}{2} n + \frac{\pi}{6}\right)$$

$$d) x(t) = ev \left\{ \sin(4\pi t) u(t) \right\}$$

Properties of the systems

- 1.28) Determine which of these properties listed below hold and which do not hold for each of the following systems.
- 1) Memory-less
- 2) Time invariant
- 3) Linear
- 4) Causal
- 5) Stable

Properties of the system

- **Memory-less system:** A system is memory-less if its output for each value of the independent variable at a given time is dependent only on the input at the same time.
- **Causality:** A system is causal if the output at any time depends only on the values of the input at present time and in the past.
- **Stability:** A stable system is one in which small inputs leads to responses that do not diverge.

Properties of the systems

- Time invariance: A system is time invariant if a time shift in the input signal results in an identical time shift in the output signal.
- Linearity: The system is linear if the response to $ax_1(t) + bx_2(t)$ is $ay_1(t) + by_2(t)$.

$$a) y[n] = x[-n]$$

$$b) y[n] = x[n-2] - 2x[n-8]$$

$$c) y[n] = nx[n]$$

$$d) ev\{x[n-1]\}$$

$$e) y[n] = \begin{cases} x[n], n \geq 1 \\ 0, n = 0 \\ x[n+1], n \leq -1 \end{cases}$$

$$f) y[n] = \begin{cases} x[n], n \geq 1 \\ 0, n = 0 \\ x[n], n \leq -1 \end{cases}$$

$$g) y[n] = x[4n+1]$$