

LTI Properties

Electrical Engineering

What linear and time-invariant require, and the labels alongside them.

Linearity and time invariance are what make convolution legal.

The two requirements

Linear: scaling and superposition both hold

Time-invariant: delay in, same delay out

Fully described by its impulse response

A sinusoid in gives a sinusoid out

Amplitude and phase change, frequency does not

Other labels

Causal: output never precedes the input

Stable: bounded input, bounded output

Memoryless: output depends on the present only

Invertible: the input can be recovered

Real: a real input gives a real output

Any system that creates a new frequency is not LTI. Clipping, mixing and squaring all fail that test immediately.