



Digital Image Processing, 2nd ed. Review: Linear Systems

Some Definitions (Con't)

The system described by a linear operator is called a *linear* system (with respect to the same class of inputs as the operator). The property that performing a linear process on the sum of inputs is the same that performing the operations individually and then summing the results is called the property of *additivity*. The property that the response of a linear system to a constant times an input is the same as the response to the original input multiplied by a constant is called the property of *homogeneity*.



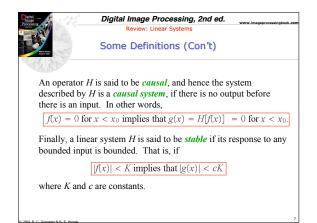
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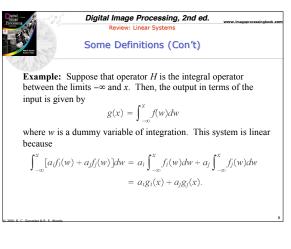
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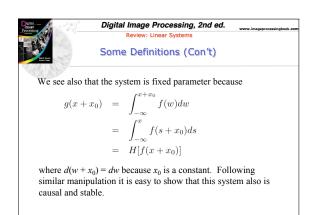
An operator H is called *time invariant* (if x represents time), *spatially invariant* (if x is a spatial variable), or simply *fixed parameter*, for some class of inputs {f(x)} if

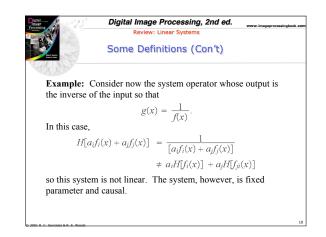
 $g_i(x) = H[f_i(x)]$ implies that $g_i(x + x_0) = H[f_i(x + x_0)]$

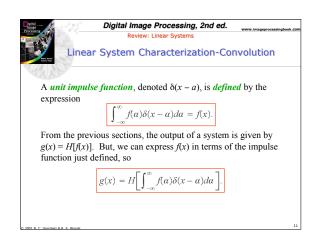
for all $f_i(x) \in \{f(x)\}$ and for all x_0 . A system described by a fixedparameter operator is said to be a *fixed-parameter system*. Basically all this means is that offsetting the independent variable of the input by x_0 causes the same offset in the independent variable of the output. Hence, the input-output relationship remains the same.

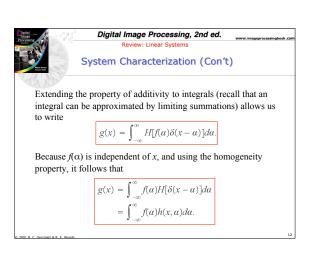


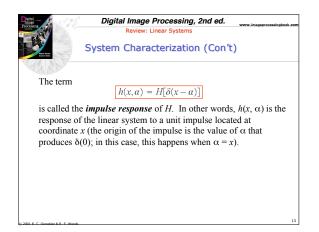


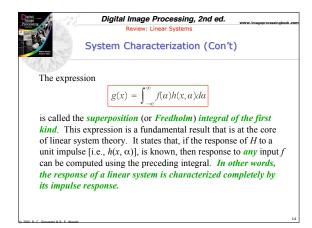


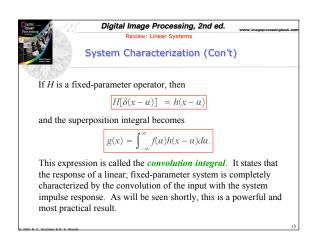


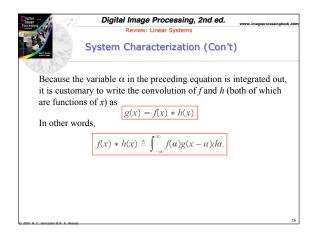




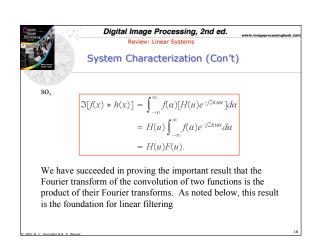


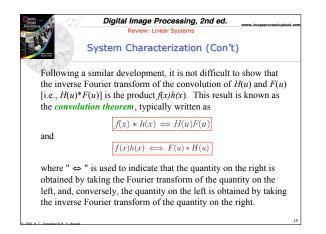


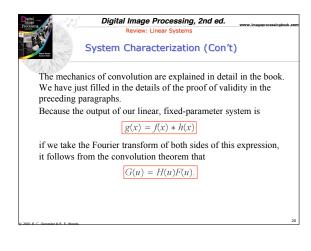


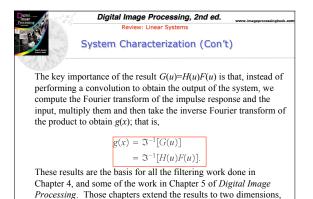


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1	Review: Linear Systems
	System Characterization (Con't)
ne Fourie	r transform of the preceding expression is
$\Im[f(x)]$	$(h * h(x)] = \int_{-\infty}^{\infty} \left[\int_{-\infty}^{\infty} f(\alpha)h(x-\alpha)d\alpha \right] e^{-j2\pi ux} dx$
	$= \int_{-\infty}^{\infty} f(\alpha) \left[\int_{-\infty}^{\infty} h(x-\alpha) e^{-j2\pi i x} dx \right] d\alpha.$
he term iı rm <i>h</i> (x –	side the inner brackets is the Fourier transform of the α). But,
	$\Im[h(x-\alpha)] = H(u)e^{-j2\pi u\alpha}$









and illustrate their application in considerable detail.

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