Importance of the Dirac-Impuls for the characterization of LTI-Systems

LTI-Systems (Linear time invariant)

$$u_I(t) \longrightarrow \boxed{g(t)} \longrightarrow u_a(t)$$

- $u_a(t) = u_I(t) \circledast g(t)$ — convolution
- $U_a(f) = U_I(f) \odot \underbrace{G(f)}_{\text{transfer function}}$ — multiplication

Linearity

=> Linear map between the input and the output

$$u_I(t) = k_1 \cdot u_{I_1}(t) + k_2\, u_{I2}(t) \Rightarrow u_a(t) = k_1 \cdot u_{a_1}(t) + k_2\, u_{a_2}(t)$$

Time invariance

$$u_I(t - t_0) \Rightarrow u_a(t - t_0)$$

=> Delay of the input signal causes an identic delay of the output signal

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Reference to the topic

- The Dirac-Impuls is very important for the impuls response and the characterization of a LTI-System

$$G(f) = \frac{U_a(f)}{\underbrace{U_I(f)}} \Rightarrow G(f) = U_a(f)$$

$U_I(f) = 1$ if input is a dirac impuls