

Problem-solving session

Inverse systems by means of the continuous-variable FT

Jaime Laviada

Área de Teoría de la Señal y Comunicaciones
Universidad de Oviedo

Exercise#1

(based on exercise 4.22 from Vol. ST-II by Emilio Gago)

The effects of the reverberation of audio signals can be modeled by means of linear and shift-invariant system whose impulse response is given by:

$$h_T(t) = \sum_{k=0}^{\infty} a^k h(t - kT) \quad (1)$$

wherein a and T are two positive real numbers, $h(t)$ is the impulse response of a LSI system, which exhibits the following relation between input and output:

$$f(t) = (e^{-t} + e^{-3t}) u(t) \rightarrow g(t) = 2(e^{-t} - e^{-4t}) u(t) \quad (2)$$

- a) Determine the simplified expression for the transfer function of the system described by (1). Remark the range of values so that the obtained expression is correct.

Exercise #1

- b) Determine the expression of the inverse system $h_T^{-1}(t)$.
- c) Sketch the signal $h_T^{-1}(t)$. Remark the weights of the different terms.