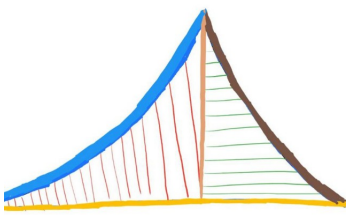
SIGNAL PROCESSING

Through GATE

EE1205-TA Group

Author: Sayyam Palrecha



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This book provides solutions to signal processing problems in GATE.

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Laplace Transform

8.1 A process described by the transfer function

$$G_p(s) = \frac{(10s+1)}{(5s+1)}$$

is forced by a unit step input at time $t = 0$. The output value immediately after the unit step input (at $t = 0^+$) is ? (Gate 2022 CH 34)

Solution:

Parameters	**Description**
$X(s)$	Laplace transform of $x(t)$
$Y(s)$	Laplace transform of $y(t)$
$G_p(s) = \frac{Y(s)}{X(s)}$	Transfer function
$x(t) = u(t)$	unit step function

Table 8.1: Given parameters

$$G_p(s) = \frac{Y(s)}{X(s)} = \frac{(10s+1)}{(5s+1)} \tag{8.1}$$

$$u(t) \xleftrightarrow{\mathcal{L}} \frac{1}{s} \tag{8.2}$$

From equation (8.2):

$$Y(s) = \frac{(10s+1)}{s\,(5s+1)} \tag{8.3}$$

$$= \frac{1}{s} + \frac{5}{5s+1} \tag{8.4}$$

Taking inverse laplace transformation,

$$\frac{1}{s} \overset{\mathcal{L}^{-1}}{\longleftrightarrow} u(t) \tag{8.5}$$

$$\frac{1}{s-c} \overset{\mathcal{L}^{-1}}{\longleftrightarrow} e^{ct}u(t) \tag{8.6}$$

$$y(t) = \left(1 + e^{\frac{-t}{5}}\right) u(t) \tag{8.7}$$

$$y(0^+) = 2 \tag{8.8}$$

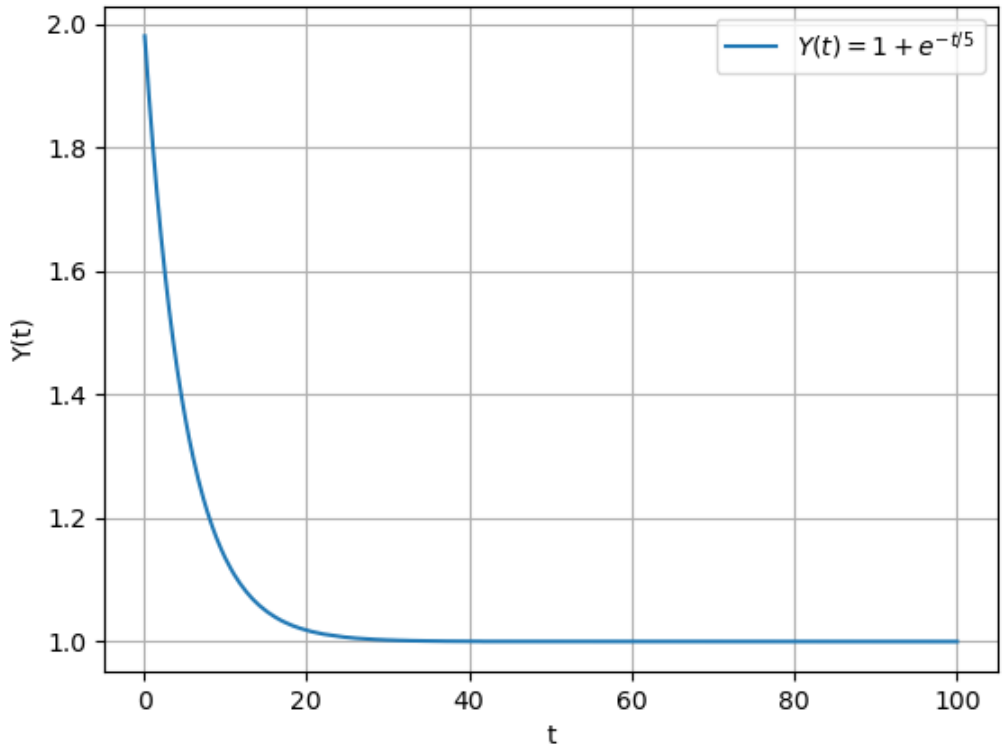

Figure 8.1: Graph of y(t)

Chapter 9

Fourier transform

9.1