

GATE 2023[IN]-36

EE23BTECH11066 - Yakkala Amarnath Karthik

Question:

The open loop transfer function of a unity gain negative feedback system is given by $G(s) = \frac{k}{s^2+4s-5}$. The range of k for which the system is stable, is (GATE EE 2022)

Solution:

Variable	Description	value
$G(s)$	Open loop transfer function	$\frac{k}{s^2+4s-5}$
$1+G(s)$	Characteristic equation	0

TABLE I

A TABLE WITH INPUT PARAMETERS

from Table I

Characteristic equation:

$$1 + G(s) = 0 \quad (1)$$

$$\Rightarrow 1 + \frac{k}{s^2 + 4s - 5} = 0 \quad (2)$$

$$\Rightarrow s^2 + 4s + (k - 5) = 0 \quad (3)$$

By routh table analysis, for a stable system:

$$k - 5 > 0 \quad (4)$$

$$\Rightarrow k > 5 \quad (5)$$