

Control System

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1. The objective of this exercise is to deduce the effect of a variable gain in the forward path transfer function on the stability of a feedback system. Let k $G(s)$ be the forward path transfer function in a unity negative feedback system. Use Matlab to determine and plot the closed loop poles in the following cases: (i) $G(s)=$ or the gain in the range $k=1:1:5$. For $k=1, 2$ and 5 , obtain the step response. For what values of the gain is the closed loop system stable? (ii) for the gain in the range $k=1:1:8$. For, 4 and 8 , obtain the step response. For what values of the gain is the closed loop system stable?

Inference

i) $k=1$

The poles lie on the LHP => that the system is stable

$K=2$

The poles lie exactly on top of the $j\omega$ axis. Hence the system is marginally stable.

$K=5$

Poles lie on the RHP and hence the system is unstable.

ii) $K=4$

The poles lie on the RHP. Hence the system is stable.

$K=8$

We have a pair of conjugate poles on the $j\omega$ axis \Rightarrow the system is marginally stable.