

Control Systems

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CONTENTS

1	Signal Flow Graph	1	10	Oscillator	2
1.1	Mason's Gain Formula . . .	1	10.1	Introduction	2
1.2	Matrix Formula	1	10.2	Example	2
2	Bode Plot	1	<i>Abstract</i> —This manual is an introduction to control systems based on GATE problems. Links to sample Python codes are available in the text.		
2.1	Introduction	1	Download python codes using		
2.2	Example	1	svn co https://github.com/gadepall/school/trunk/control/codes		
3	Second order System	1			
3.1	Damping	1	1 SIGNAL FLOW GRAPH		
3.2	Example	1	1.1 Mason's Gain Formula		
4	Routh Hurwitz Criterion	1	1.2 Matrix Formula		
4.1	Routh Array	1	2 BODE PLOT		
4.2	Marginal Stability	1	2.1 Introduction		
4.3	Stability	1	2.2 Example		
4.4	Example	2	3 SECOND ORDER SYSTEM		
5	State-Space Model	2	3.1 Damping		
5.1	Controllability and Observability	2	3.2 Example		
5.2	Second Order System	2	4 ROUTH HURWITZ CRITERION		
5.3	Example	2	4.1 Routh Array		
5.4	Example	2	4.2 Marginal Stability		
5.5	Example	2	4.3 Stability		
6	Nyquist Plot	2	A closed loop system has the characteristic equation given by		
7	Compensators	2	$s^3 + Ks^2 + (K + 2)s + 3 = 0 \quad (4.3.0.1)$		
7.1	Example	2	Determine the condition for K for which the system is stable.		
8	Gain Margin	2	Solution: Computing the Routh array for the given characteristic equation, we get-		
8.1	Introduction	2	$\begin{vmatrix} s^3 & 1 & K+2 & 0 \\ s^2 & K & 3 & 0 \\ s & \frac{K^2+2K-3}{K} & 0 & 0 \\ s^0 & 3 & 0 & 0 \end{vmatrix} \quad (4.3.0.2)$		
8.2	Example	2			
9	Phase Margin	2			

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According to the Routh-Hurwitz stability criterion, for the system to be stable there should be no sign changes in the first column of the Routh array. That means-

$$K > 0 \text{ and } \frac{K^2 + 2K - 3}{K} > 0 \quad (4.3.0.3)$$

$$\Rightarrow K > 0 \text{ and } (K - 1)(K + 3) > 0 \quad (4.3.0.4)$$

which gives us

$$K > 0 \text{ and } (K > 1 \text{ or } K < -3). \quad (4.3.0.5)$$

Note that K cannot be negative.

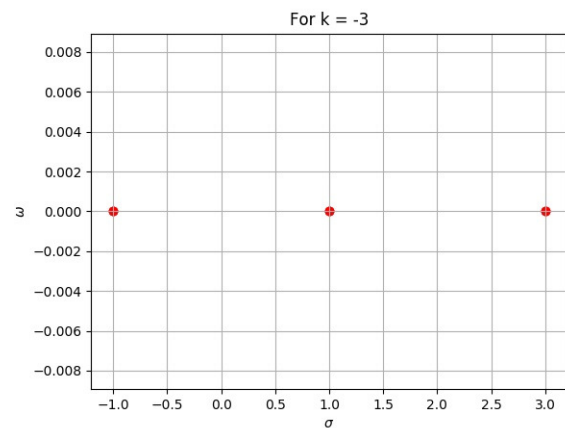
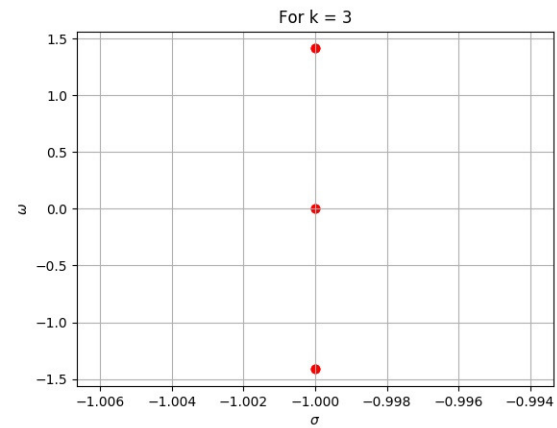
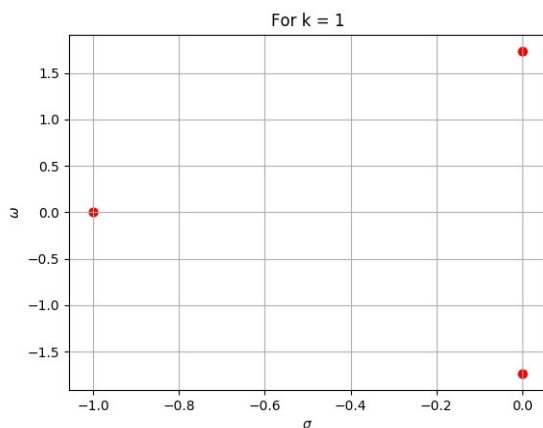
$$\Rightarrow K > 1 \quad (4.3.0.6)$$

The program to compute the routh-array and stability for different values of K.

```
codes/ee18btech11039/routh_array.py
```

The program for plotting the poles of the system for different values of K.

```
codes/ee18btech11039/pole_plot.py
```



4.4 Example

5 STATE-SPACE MODEL

5.1 Controllability and Observability

5.2 Second Order System

5.3 Example

5.4 Example

5.5 Example

6 NYQUIST PLOT

7 COMPENSATORS

7.1 Example

8 GAIN MARGIN

8.1 Introduction

8.2 Example

9 PHASE MARGIN

10 OSCILLATOR

10.1 Introduction

10.2 Example

Fig. 4.3.0: Pole plots for different values of K