Ministry of Higher Education		Subject	Control System I
Al-Mustaqbal University		Stage	Fourth stage (Second Semester)
College of Engineering & Technologies			
Biomedical Engineering Department		Lecturer	Dr. Mujtaba A. Flayyih
		Data	5/2/2025

Second semester (2024-2025)

EXP NO.2

1.1 Routh's –Hurwitz Stability

Objectives:

It is a method for determining continuous system stability The Routh-Hurwitz criterion states that "the number of roots of the characteristic equation with positive real parts is equal to the number of changes in sign of the first column of the Routh array.

Example:1 Define if the closed loop system is stable?

$$G(s) = \frac{1}{s^3 + 6s^2 + 12s + 8}$$

ANS: A system is stable if there are no sign changes in the first column of the Routh table and all poles in the left half of the s-plane

```
clear all
close all
clc

%If control system is (stable)
n=[0 0 0 1];
d=[1 6 12 8];
g=tf(n,d)
zpk(g)
pzmap(g)
```

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Example 2: Define if the closed loop system is Unstable ?

$$G(s) = \frac{25}{6s^3 + 2s^2 + 12s + 4}$$

Ans:

A system is imaginary if at least one of the roots lies on the imaginary axis.

```
clearall
close all
clc
%%If control system is (imaginary)
n=[0 0 0 25];
d=[6 2 12 4];
g=tf(n,d)
zpk(g)
pzmap(g)
```

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1.2 Root Locus

*Root Locus analysis is a graphical method for examining how the roots of a system change with variation of a certain system parameter.

* Root locus is the path of the roots of the characteristic equation traced out in the s-plane as a system parameter varies from zero to infinity

Example 1: Find Root Locus of the closed loop transfer function

$$G(s) = \frac{k}{(s+2)(s+4)} \qquad ; \quad H(s) = 1$$

Ans:

```
clear all
close all
clc
s=tf('s');
n=[1];
d=[1 6 8];
GH=tf(n,d)
rlocus(GH)
```

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Example 2: Find Root Locus of the closed loop transfer function

$$G(s) = \frac{k(s+0.4)}{s^2(s+3.6)} \qquad ; \quad H(s) = 1$$

```
clear all
close all
clc
s=tf('s')
n=[0 0 1 0.4];
d=[1 3.6 0 0]
gh=tf(n,d)
rlocus(gh)
```