Routh's Method

Examine the **absolute stability** of the system having following **characteristic equation**, using Routh's method and **verify** using extraction of **poles.**

$$s^3 + 4s^2 + 6s + 4 = 0$$

1	6	
4	4	
5	0	
4	0	No Sign change, system stable.

-2.0000
-1.0000 - 1.0000i
-1.0000 + 1.0000i

Routh's Method

Construct **Routh's** array for the following **characteristic** equations and **determine** the number of **poles** either on **imaginary** axis or in the **right** half of s-plane.

$$s^5 + 4s^4 + 6s^3 + 24s^2 + 25s + 100 = 0$$

1	6	25
4	24	100
0(16)	0(48)	0
12	100	0
−85.3	0	
100		

Zero Row → poles symmetric

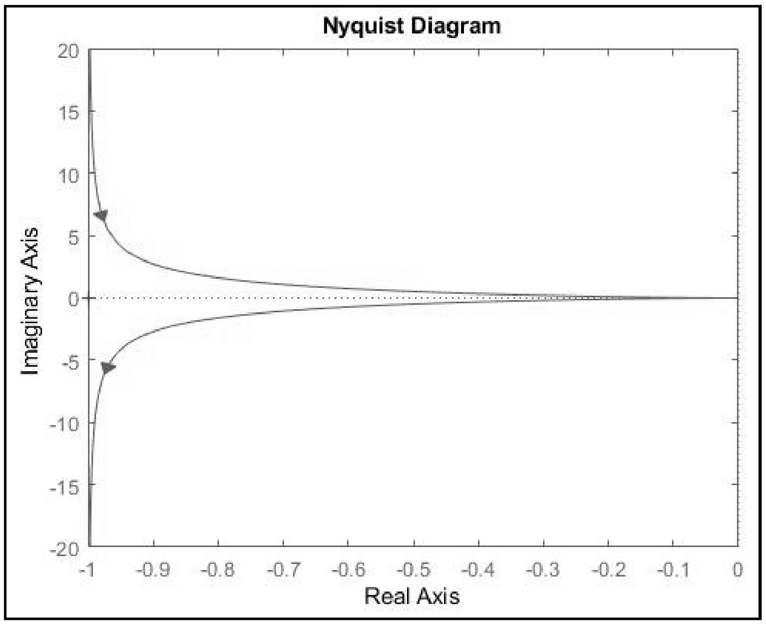
Two sign changes → 2 poles in RH

-4.0000
-1.0000 - 2.0000i
-1.0000 + 2.0000i
1.0000 - 2.0000i
1.0000 + 2.0000i

Nyquist Stability Analysis

Examine **closed loop** absolute stability of following **plant** using **Nyquist** stability criterion and **verify** the same using the actual **closed** loop pole **locations.**

$$G(s) = \frac{1}{s(s-1)}$$



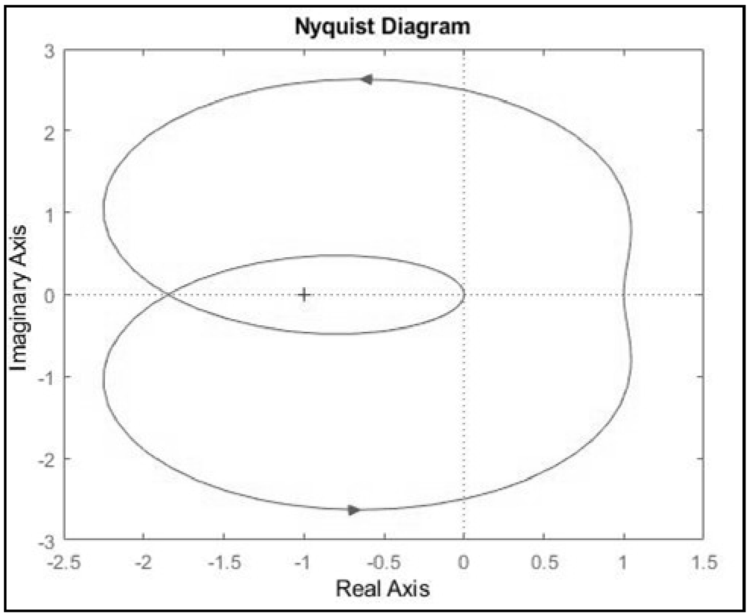
1 Clockwise encirclement
i.e. N = 1, P = 1, So, Z = 2
Closed loop unstable.

0.5000 + 0.8660i
0.5000 – 0.8660i

Nyquist Stability Analysis

Examine **closed loop** absolute stability of following **plant** using **Nyquist** stability criterion and **verify** the same using the actual closed loop pole locations.

$$G(s) = \frac{s^2 + 2s + 1}{s^3 + 0.2s^2 + s + 1}$$



1 Clockwise encirclement
i.e. N = -2, P = 2, So, Z = 0
Closed loop stable.

-0.751
-0.2240 + 1.6200i
-0.2240 – 1.6200i