EXPERMINT NO.5

Drawing Nyquist Plot with MATLAB

Nyquist plots, just like Bode diagrams, are commonly used in the frequency-response representation of linear, time-invariant, feedback control systems. Nyquist plots are polar plots, while Bode diagrams are rectangular plots. One plot or the other may be more convenient for a particular operation, but a given operation can always be carried out in either plot. The MATLAB command nyquist computes the frequency response for continuous- time, linear, time-invariant systems.When invoked without left-hand arguments, nyquist produces a Nyquist plot on the screen.

Example 1: Draw a Nyquist plots with Matlab OF TF

$$G(s) = \frac{1}{s^2+0.8s+1}$$

Ans:

```
clear all
close all
clc
n=[1];
d=[1 0.8 1];
g=tf(n,d)
nyquist(g)
```

Example 2: Draw a Nyquist plots with Matlab of TF

$$G(s) = \frac{s^2+2s+3}{s^3+2s^2+3s+7}$$

Ans:

```
clear all
close all
clc
n=[0 1 2 3 ];
d=[1 2 3 7];
g=tf(n,d)
nyquist(g)
```

Drawing Nyquist Plots of a System Defined in **State Space**. Consider the system defined by

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u}$$
$$\mathbf{y} = \mathbf{C}\mathbf{x} + \mathbf{D}\mathbf{u}$$

Where

X= state vector (n-vector)

Y=output vector (m-vector)

u=control vector (r-vector)

A=state matrix (n*n matrix)

B=control matrix (n*r matrix)

C=output matrix (m*n matrix)

D = direct transmission matrix (m*r matrix)

Example 3: Draw a Nyquist plots with Matlab of **SS**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -25 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 25 \end{bmatrix} u$$

$$y = [1 \quad 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0] u$$

Ans:

```
clear all
close all
clc
A = [0 1;-25 -4];
B = [0;25];
C = [1 0];
D = [0];
nyquist(A,B,C,D)
```

Example 4: Draw a Nyquist plots with Matlab of SS

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 6.5 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

Ans:

```
clear all
close all
clc
A =[-1 -1;6.5 0];
B =[1 1;1 0];
C =[1 0;0 1];
D =[0 0;0 0];
nyquist(A,B,C,D)
```