

FAKULTAS TEKNIK UNIVERSITAS NEGERI YOGYAKARTA					
ELKA	Prakt Sistem Kendali Dasar	JS:08	Response frekuensi	SEM. GNP	1 SKS 4 X 50'
Pengampu	Dr. Fatchul Arifin fatchul@uny.ac.id		Tanggal: Januari 2015		

Tujuan

Setelah mengikuti praktikum ini mahasiswa dapat : Mensimulasikan response frekuensi dari suatu sistem

Teori Singkat

The frequency response is a representation of the system's response to sinusoidal inputs at varying frequencies. The output of a linear system to a sinusoidal input is a sinusoid of the same frequency but with a different magnitude and phase. The frequency response is defined as the magnitude and phase differences between the input and output sinusoids.

Note that the location of the pole or zero(a) will greatly affect the frequency response. If we have a pole close to the origin, the response at lower frequencies will undergo the most drastic changes. If we have a pole or zero farther from the origin, the response at higher frequencies will undergo the most drastic changes.

The **gain margin** is defined as the change in open loop gain required to make the system unstable. Systems with greater gain margins can withstand greater changes in system parameters before becoming unstable in closed loop. The **phase margin** is defined as the change in open loop phase shift required to make a closed loop system unstable. The phase margin is the difference in phase between the phase curve and -180 deg at the point corresponding to the frequency that gives us a gain of 0dB (the gain cross over frequency, ω_{gc}). Likewise, the gain margin is the difference between the magnitude curve and 0dB at the point corresponding to the frequency that gives us a phase of -180 deg (the phase cross over frequency, ω_{pc}).

The bandwidth frequency is defined as the frequency at which the closed-loop magnitude response is equal to -3 dB. Atau bandwidth frequency equals the frequency at which the open-loop magnitude response is between -6 and - 7.5dB, assuming the open loop phase response is between -135 deg and -225 deg.

In order to illustrate the importance of the bandwidth frequency, we will show how the output changes with different input frequencies. We will find that sinusoidal inputs with frequency less than ω_{bw} (the bandwidth frequency) are tracked "reasonably well" by the system. Sinusoidal inputs with frequency greater than ω_{bw} are attenuated (in magnitude) by a

Bode Plots

As noted above, a Bode plot is the representation of the magnitude and phase of $G(j\omega)$ (where the frequency vector ω contains only positive frequencies).

Cara Kerja:

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I. Pengaruh pole dan zero Terhadap response Frekuensi

Ketikkan program dibawah, lalu jalankan:

```
% Pengaruh pole dan zero terhadap response frekuensi
```

```
% Untuk pole dkt origin
```

```
%          1/(s + 0.1)
```

```
Subplot (2,2,1);
```

```
bode(1,[ 1, 0.1])
```

```
% Untuk pole jauh dari origin
```

```
%          1/(s + 10)
```

```
Subplot (2,2,2);
```

```
bode(1,[ 1, 10])
```

```
% Untuk Zero dekat dg origin
```

```
%          (s + 0.1)
```

```
Subplot (2,2,3);
```

```
bode([1, 0.1], 1)
```

```
% Untuk zero jauh dari origin
```

```
%          (s + 10)
```

```
Subplot (2,2,4);
```

```
bode([1, 10], 1)
```

Tugas: Gambar/catat hasilnya, amati komentar/analisa anda?

II. Menghitung phase margin dan gain margin

```
% Diketahui sebuah sistem mempunyai persamaan TF = 50/s3+9s2+30s+40
```

```
% bode bode(50,[1 9 30 40])
```

Amati hasilnya! Hitung berapa phase margin dan gain marginya? (caranya lihat di dasar teori)

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The phase margin is the difference in phase between the phase curve and -180 deg at the point corresponding to the frequency that gives us a gain of 0dB (the gain cross over frequency, W_{gc}). Likewise, the gain margin is the difference between the magnitude curve and 0dB at the point corresponding to the frequency that gives us a phase of -180 deg (the phase cross over frequency, W_{pc}).

III. Menghitung Band width

Diketahui sebuah sistem

% TF close loop nya: $1/(s^2 + 0.5s + 1)$

% Hitunglah bandwidtnya! Ketikkan :

`bode(1, [1 0.5 1])`

Amati hasilnya (gambar diagram bode) dan carilah BW nya! Caranya seperti pada dasar teori :

The bandwidth frequency is defined as the frequency at which the **closed-loop** magnitude response is equal to -3 dB

Berapakah BW yang anda dapatkan.

Selanjutnya berikan masukan ke sistem dengan sinyal sinus frekuensi : 0,3 rad

`w= 0.3;`

`num = 1;`

`den = [1 0.5 1];`

`t=0:0.1:100;`

`u = sin(w*t);`

`[y,x] = lsim(num,den,u,t);`

`plot(t,y,t,u)`

`axis([50,100,-2,2])`

amati bagaimanakah hasil outputnya ?

Sekarang untuk input lebih besar dari BW, misal input $w=3$,

`w = 3;`

`num = 1;`

`den = [1 0.5 1];`

`t=0:0.1:100;`

`u = sin(w*t);`

`[y,x] = lsim(num,den,u,t);`

`plot(t,y,t,u)`

`axis([90, 100, -1, 1])`

Amati hasilnya ! Apa kometar anda ?