Corso di Laurea in Ingegneria Informatica - Politecnico di Torino
Anno Accademico 2023-2024

CONTROLLI AUTOMATICI (18AKSOA) (IA-ZZ)

Esercitazione di laboratorio - Lab 2

Obiettivi principali

Conclusa l'esercitazione, lo studente dovrà essere in grado di:

1. Disegnare, sia qualitativamente (sebbene approssimativamente) sia quantitativamente (mediante matlab) i diagrammi di Bode e i diagrammi di Nyquist della risposta in frequenza di sistemi dinamici LTI.

Problema 1

Per ciascuna delle funzioni di trasferimento riportate di seguito per comodità, disegnare i diagrammi di Bode e i diagrammi di Nyquist delle relative risposte in frequenza.

$$H(s) = \frac{1}{s(s+2)(s+4)} \tag{1}$$

$$H(s) = \frac{-0.1(1-2s)}{s(s+0.2)(1+s)} \tag{2}$$

$$H(s) = \frac{1}{s^2(s+3)} \tag{3}$$

$$H(s) = \frac{2(1+0.5s)}{(1+s)(1-s)^2} \tag{4}$$

$$H(s) = \frac{s^2+1}{(s-2)(s+2)(s+4)} \tag{5}$$

$$H(s) = \frac{0.125(1+s^2)}{s(1+0.25s)(1+0.5s)} \tag{6}$$

$$Hs) = \frac{s-2}{(s+2)(s^2+1)} \tag{7}$$

$$H(s) = \frac{0.25}{s(1-0.5s)^2} \tag{8}$$

$$H(s) = \frac{1}{(s^2+1)(s+2)} \tag{9}$$

$$H(s) = \frac{-(1-s)}{s(1+s^2)} \tag{10}$$

$$H(s) = \frac{s+1}{(s+2)(s^2+4s+5)} \tag{11}$$

$$H(s) = \frac{(s+3)(s^2+2s+2)}{s(s-1)(s+2)(s+4)} \tag{12}$$

$$H(s) = \frac{1}{2s^3} \tag{13}$$

$$H(s) = \frac{s^3+4s^2+7s+6}{s^4+5s^3+10s^2+11s+3} \tag{14}$$

$$H(s) = \frac{(s^2-1)}{s^3+s^2+s-3} \tag{15}$$

Useful Matlab commands

Following is a list of commands which are useful for this homework. If you type `help control`, you get the complete list of commands included in the Control System Toolbox of Matlab. Use `help` in MATLAB for more information on how to use any of these commands.

- `help`: Matlab help documentation.
- `figure`: Create a new figure or redefine the current figure, see also subplot, axis.
- `hold`: Hold the current graph, see also figure.
- `axis`: Set the scale of the current plot, see also plot, figure.
- `plot`: Draw a plot, see also figure, axis, subplot.
- `xlabel/ylabel`: Add a label to the horizontal/vertical axis of the current plot, see also title, text, gtext.
- `title`: Add a title to the current plot.
- `text`: Add a piece of text to the current plot, see also title, xlabel, ylabel, gtext.
- `subplot`: Divide the plot window up into pieces, see also plot, figure.
- `abs`: returns the absolute value of of a complex number.
- `angle`: returns the phase angles, in radians, of a complex number.
- `squeeze`: Remove singleton dimensions.
- `bode`: Draw the Bode plot, see also logspace, margin, nyquist1.
- `polar`: Draw a polar coordinate plot.
- `nyquist`: Draw the Nyquist plot.
- `nyquist1`: Draw the Nyquist plot, see also nyquist. Note this command was written to replace the MATLAB standard command nyquist to get more accurate Nyquist plots.
- `grid`: Draw the grid lines on the current plot.
- `logspace`: Provides logarithmically spaced vector.
- `dcgain`: Computes the steady-state (D.C. or low frequency) gain of LTI models.
- `zpk`: Create zero-pole-gain models or convert to zero-pole-gain format.