Frequency Response

Example

Using MATLAB plot the frequency response of the transfer function given as

$$H(s) = \frac{2s^2 + 4}{s^2 + 4s + 16}$$

Solution

The MATLAB function *freqs* can be used to obtain the frequency response of the transfer function $H(s)$. Given the coefficients of the numerator and denominator polynomials, the MATLAB *freqs* function returns the complex frequency response vector **hs**. The general form of the *freqs* function is

hs = *freqs* (**num**, **den, w**)

Vectors **num** and **den** specify the coefficients of the numerator and denominator polynomials in descending powers of *s*. The frequency response is rated at the points specified in the vector **w** (in rad/s).

Other versions using the command *freqs* are

[**hs**, **w**] = *freqs* (**num**, **den**) ... automatically picks a set of 200 frequency points **w** on which to compute the frequency response **hs**

[**hs**, **w**] = *freqs* (**num**, **den,** *n*) ... automatically picks *n* number of frequencies on which to compute the frequency response **hs**

freqs with no output arguments plots the magnitude and phase response versus frequency in the current figure window

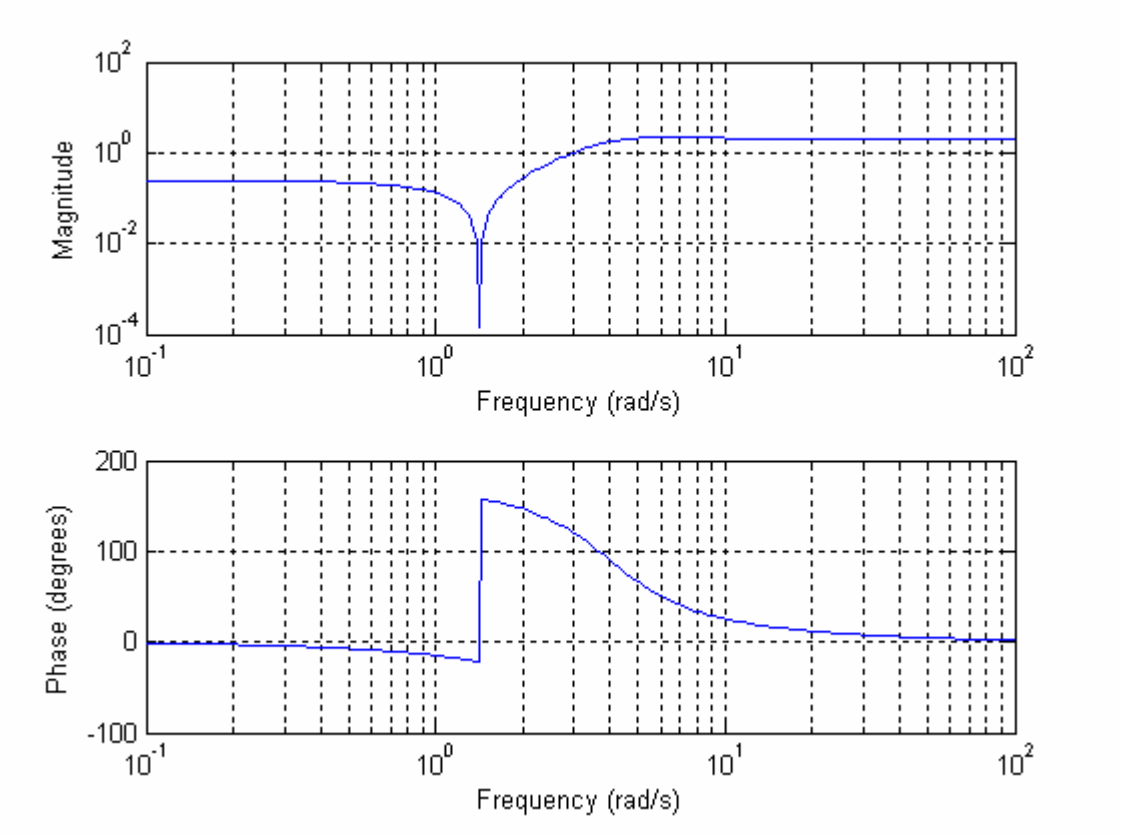
For more information write the command *help freqs* in the MATLAB command window.

The short MATLAB program for solving this task is

MATLAB Script

```
% The frequency response
clear; clc;
numerator = [2 0 4];
denominator = [1 4 16];
freqs(numerator,denominator);
```

The plots obtained from MATLAB are



You can also create the plot with:

```
[hs,w] = freqs(numerator,denominator);
mag = abs(hs); phase = angle(hs);
subplot(2,1,1); loglog(w,mag); grid on;
subplot(2,1,2); semilogx(w,phase); grid on;
```

To convert to hertz, degrees, and decibels, use:

```
f = w/(2*pi);
mag = 20*log10(mag);
phase = phase*180/pi;
```