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Project 1 Body Plot of Transfer Function in MATLAB

EE 4360

1. **Transfer function**

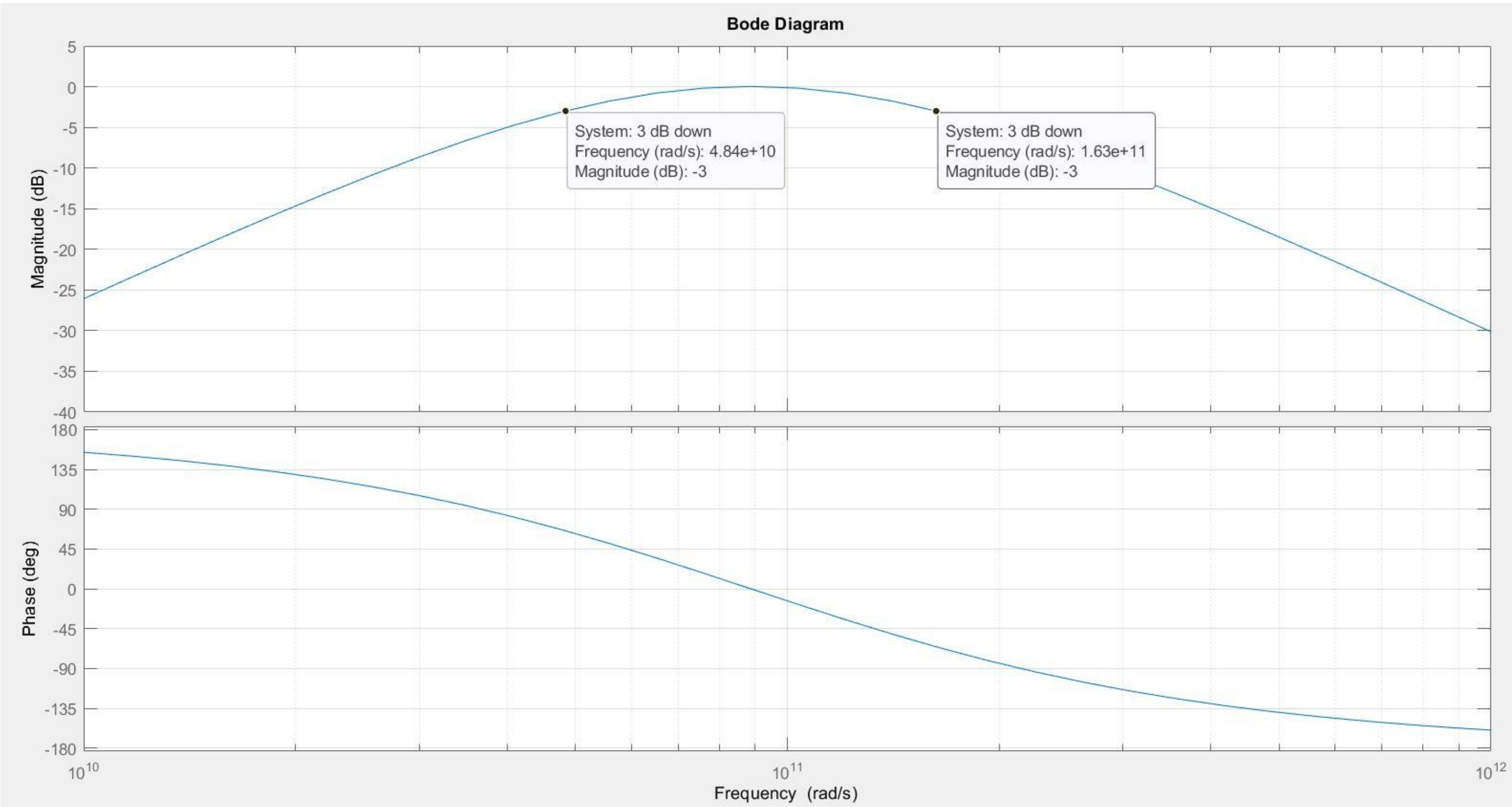
22

$$\frac{(3.16\,\mathrm{E}22)\cdot s^3}{s(s+8.8\,\mathrm{E}10)^3(s+9.1\,\mathrm{E}10)}$$

Zeros	Poles
s = 0	s = 0
	s = -8.8E10
	s = -9.1E10

The transfer function used for this project has one zero and three poles. The zero values are the values of s that make the numerator go to zero. In this case when s equals zero the value of the numerator is zero. The poles are the values of s that make the denominator go to zero. When s equals 0, -8.8E10, and -9.1E10 the value of the denominator is zero.

2. Bode Plot in MATLAB



In the magnitude plot above the two points measured 3dB down from the maximum represent where the power of the signal is cut in half. After the 3dB roll off the plot has a slope of about -40 dB per decade. The phase plot shows the signal has a phase of zero degrees at the same frequency as the maximum of the magnitude graph.

```
>> sys = tf([3.16e22 0 0 0],[1 3.55e11 47.256e21 2.795e33 62.01e42 0])

sys =

                          3.16e22 s^3
  ------------------------------------------------------------
  s^5 + 3.55e11 s^4 + 4.726e22 s^3 + 2.795e33 s^2 + 6.201e43 s

Continuous-time transfer function.

>> bode (sys)
>> grid
```

The code above represents my transfer function in MATLAB. I had to convert the numerator and denominator to polynomial form. Then I entered the coefficients of each polynomial in the “tf” function. Lastly, I output the body plot by plotting my transfer function.

3. Discussion

The bode plot mostly resembles a bandpass filter. The signal rises to a frequency of 4.84E10 rad/s before reaching the first -3dB cut off. The signal stays above -3dB until reaching a frequency of 1.63E11 rad/s. These characteristics are representative of a bandpass filter with a bandwidth of 114.6E9 rad/s or 18.2 GHz from 4.84E10 to 1.63E11 rad/s.

A transfer function models the output of a system when given an input. In this case it is a mathematical expression which gives a response to a system when multiplied by an input.

Transfer functions are useful in all sorts of systems when looking for a desired output. They produce a mathematical expression which models the output of a system. This can help save time, lower costs, and optimize resources when designing a system.

The transfer function tells us how the system will respond for a given input. It gives us a mathematical expression of the response.