Bode plot

I would like to express my gratitude to all those who gave me the possibility to complete this thesis. I sincerely thank my Prof. Ms. Pooja Sahota for his guidance, help and motivation. Apart from the subject of my research, I learnt a lot from him, which I am sure will be useful in different stages of my life. I am also very thankful to my parents for there help. Thank You Bode plot A Bode plot is a graph of the transfer function of a linear, time-invariant system versus frequency, plotted with a log-frequency axis, to show the system's frequency response.

It is usually a combination of a Bode magnitude plot, expressing the magnitude of the frequency response gain, and a Bode phase plot, expressing the frequency response phase shift. Among his several important contributions to circuit theory and control theory, engineer Hendrik Wade Bode (1905–1982), while working at Bell Labs in the United States in the 1930s, devised a simple but accurate method for graphing gain and phase-shift plots. These bear his name, Bode gain plot and Bode phase plot (pronounced Boh-dee in English, Bow-duh in Dutch).

The magnitude axis of the Bode plot is usually expressed as decibels of power, that is by the 20 log rule: 20 times the common (base 10) logarithm of the amplitude gain. With the magnitude gain being logarithmic, Bode plots make multiplication of magnitudes a simple matter of adding distances on the graph (in decibels), since [pic] A Bode phase plot is a graph of phase versus frequency, also plotted on a log-frequency axis, usually used in conjunction with the magnitude plot, to evaluate how much a signal will be phase-shifted. For example a signal described by: Asin(? t) may be attenuated but also phase-shifted.

If the system attenuates it by a factor x and phase shifts it by the signal out of the system will be (A/x) sin(? t ? ?). The phase shift ? is generally a function of frequency. Phase can also be added directly from the graphical values, a fact that is mathematically clear when phase is seen as the imaginary part of the complex logarithm of a complex gain. In Figure 1(a), the Bode plots are shown for the one-pole highpass filter function: [pic] where f is the frequency in Hz, and f1 is the pole position in Hz, f1 = 100 Hz in the figure.

Using the rules for complex numbers, the magnitude of this function is hile the phase is: Care must be taken that the inverse tangent is set up to return degrees, not radians. On the Bode magnitude plot, decibels are used, and the plotted magnitude is: In Figure 1(b), the Bode plots are shown for the one-pole lowpass filter function: [pic] Also shown in Figure 1(a) and 1(b) are the straight-line approximations to the Bode plots that are used in hand analysis, and described later. The magnitude and phase Bode plots can seldom be changed independently of each other — changing the amplitude response of the system will most likely change the phase characteristics and vice versa.

For minimum-phase systems the phase and amplitude characteristics can be obtained from each other with the use of the Hilbert transform. If the transfer function is a rational function with real poles and zeros, then the Bode plot can be approximated with straight lines. These asymptotic approximations are called straight line Bode plots or uncorrected Bode plots and are useful because they can be drawn by hand following a few simple rules. Simple plots can even be predicted without drawing them. The approximation can be taken further by correcting the value at each cutoff frequency. The plot is then called a corrected Bode plot.