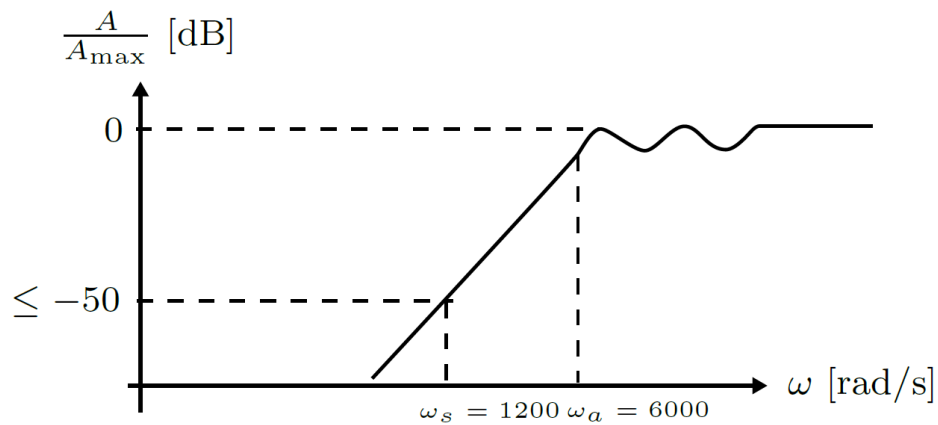


Exercise 1.1 (Butterworth)

Design a Butterworth high-pass filter that meets the following amplitude characteristic:

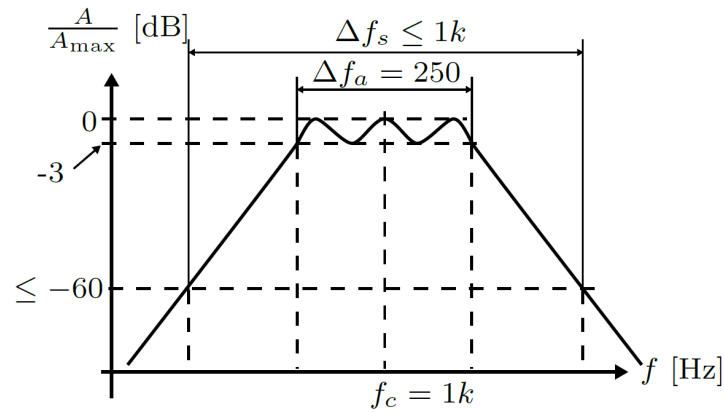


As a solution to the task, you should go through the following steps:

1. Determine the stopband frequency for the normalized low-pass filter.
2. Determine the necessary filter order.
3. Determine the normalized and denormalized high-pass filter.
4. Draw a Bode diagram in MATLAB. (try using function `bode()`, and `freqs()`, think about their differences)
5. Simulate the filter with an input signal $\sin(\omega t)$, where the angular frequency ω is 500 rad/s, 1200 rad/s, 6000 rad/s, 10000 rad/s. Compare the results with the amplitude and phase characteristics of the filter.

Exercise 1.2 (Chebyshev)

Design a Chebyshev band-pass filter that meets the following amplitude characteristic:



As a solution to the task, you should go through the following steps:

1. Determine the parameters W_a , W_s , and F for the normalized band-pass filter.
2. Determine the necessary filter order.
3. Design the band-pass filter in MATLAB (both the normalized and denormalized).
4. Simulate the filter with an input signal $\sin(\omega t)$, where the angular frequency ω is 3000 rad/s, 6000 rad/s, 9000 rad/s. Compare the results with the amplitude and phase characteristics of the filter.