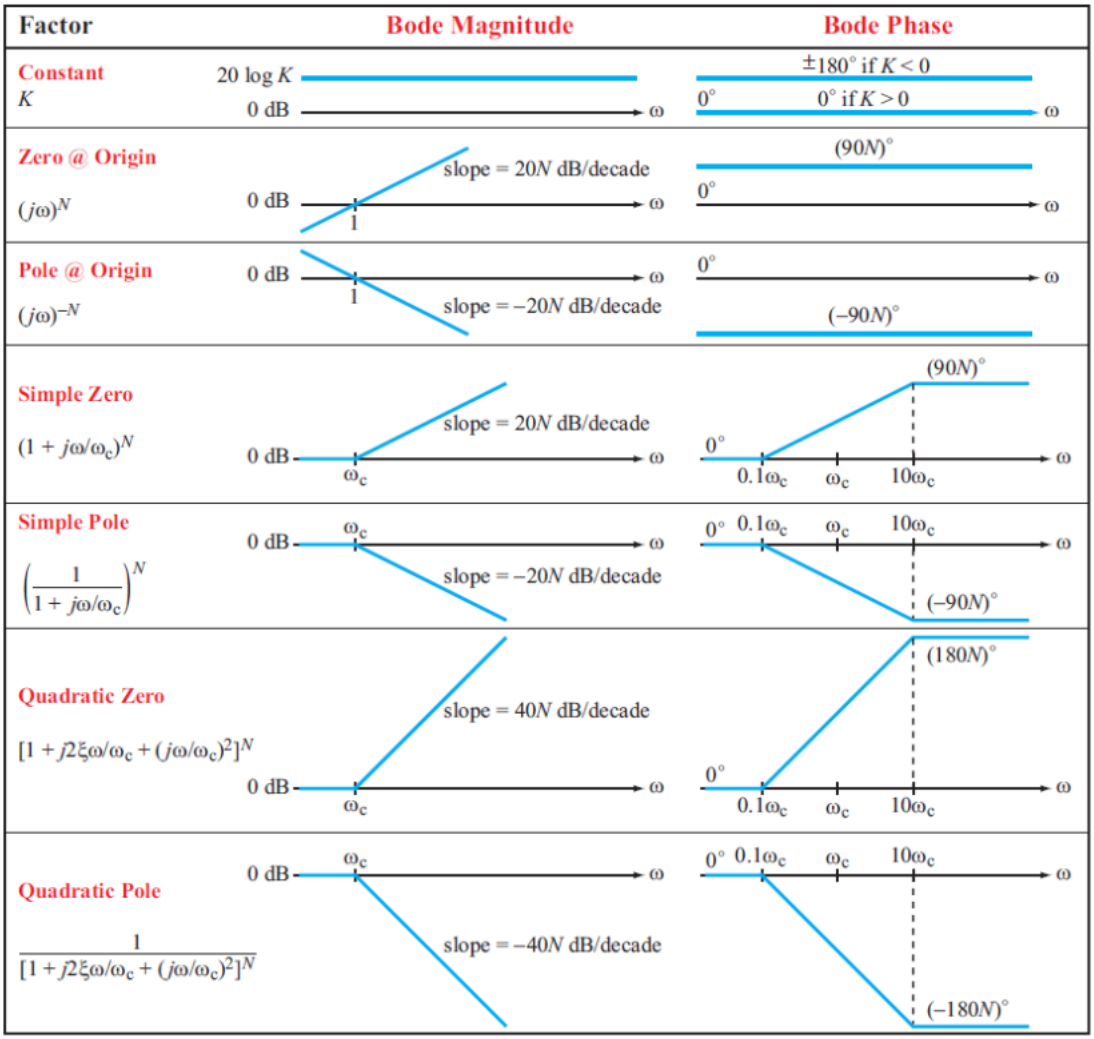
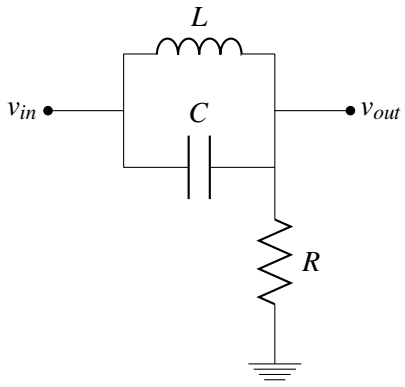
Bode Plots


Factor
Bode Magnitude
Bode Phase
Constant
K
20 log K
0 dB
ω
±180° if K < 0
0°
0° if K > 0
Zero @ Origin
(jω)^N
slope = 20N dB/decade
(90N)°
Pole @ Origin
(jω)^−N
slope = −20N dB/decade
(−90N)°
Simple Zero
(1 + jω/ω_c)^N
ω_c
0.1ω_c
10ω_c
Simple Pole
(1/(1 + jω/ω_c))^N
Quadratic Zero
[1 + j2ξω/ω_c + (jω/ω_c)^2]^N
slope = 40N dB/decade
(180N)°
Quadratic Pole
1/[1 + j2ξω/ω_c + (jω/ω_c)^2]^N
slope = −40N dB/decade
(−180N)°

1. An RLC example



For the RLC filter above, with component values $R = 1\,\text{k}\Omega$, $C = 1\,\text{nF}$, and $L = 1\,\mu\text{H}$,

(a) Find the transfer function. The easiest way is probably to treat it as a voltage divider as in the previous problem.

(b) Create a Bode plot of that transfer function.

(c) What important information is that Bode plot missing?

2. Factoring and Manipulating Transfer Functions

Make a Bode plot of the following more complicated transfer function:

$$H(s) = \frac{1}{10}\frac{((j\omega)^2 + 110j\omega + 1000)(j\omega + 10000)}{(j\omega + 1000)((j\omega)^2 + 101j\omega + 100)}$$