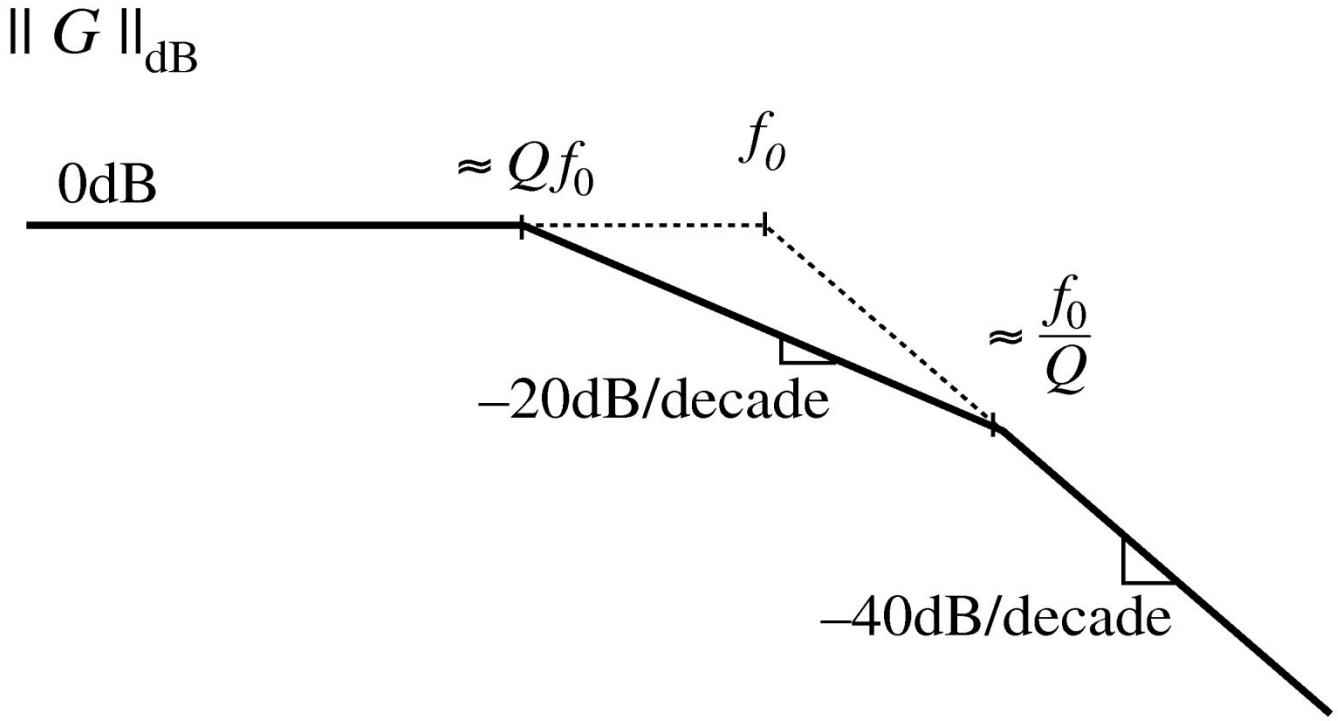
The Low-Q Approximation

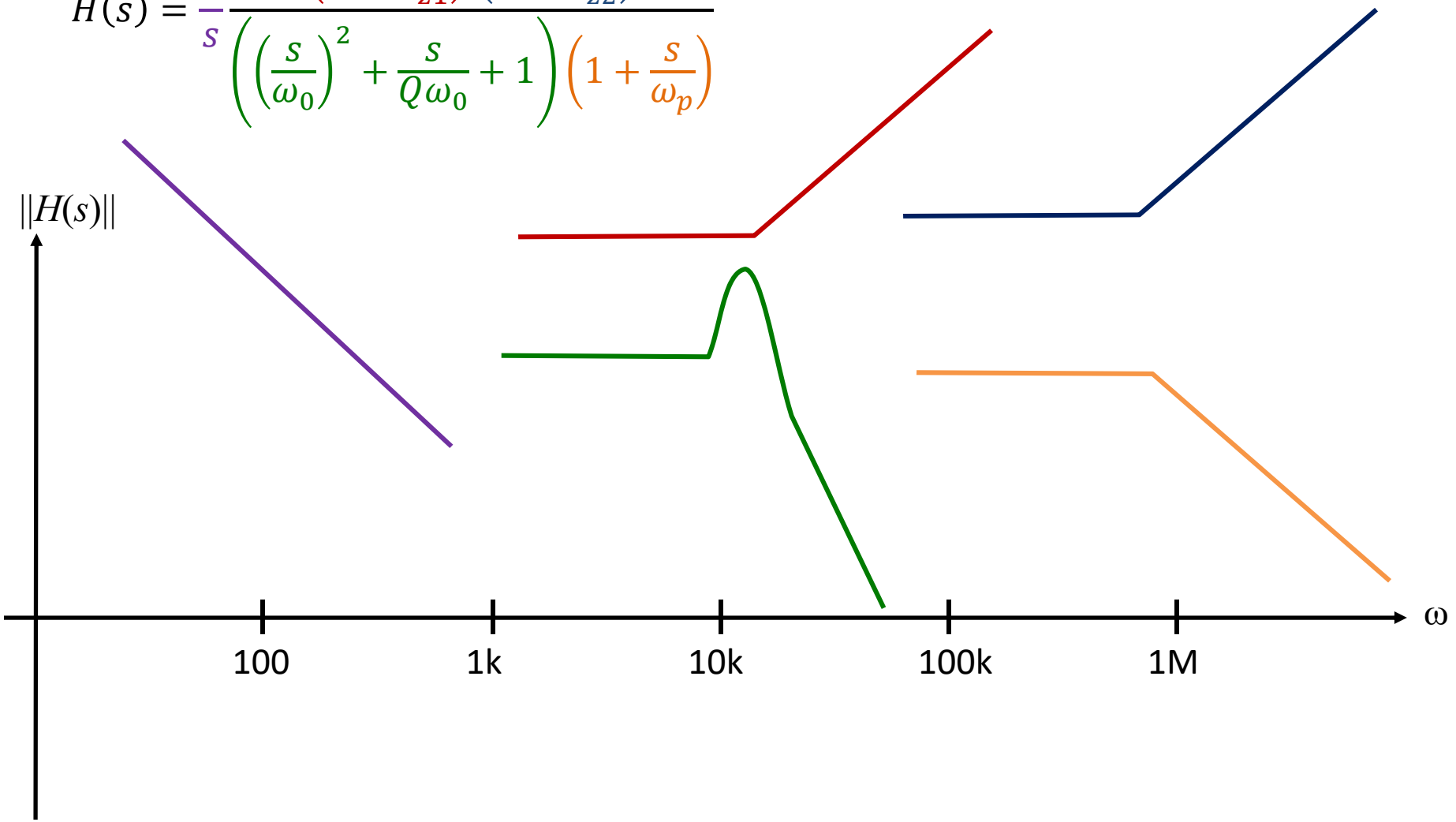
for $Q \ll 0.5$



Example

A	w_{z1}	w_{z2}	ω_0	Q	ω_p
1000	100	10k	1k	10	100k

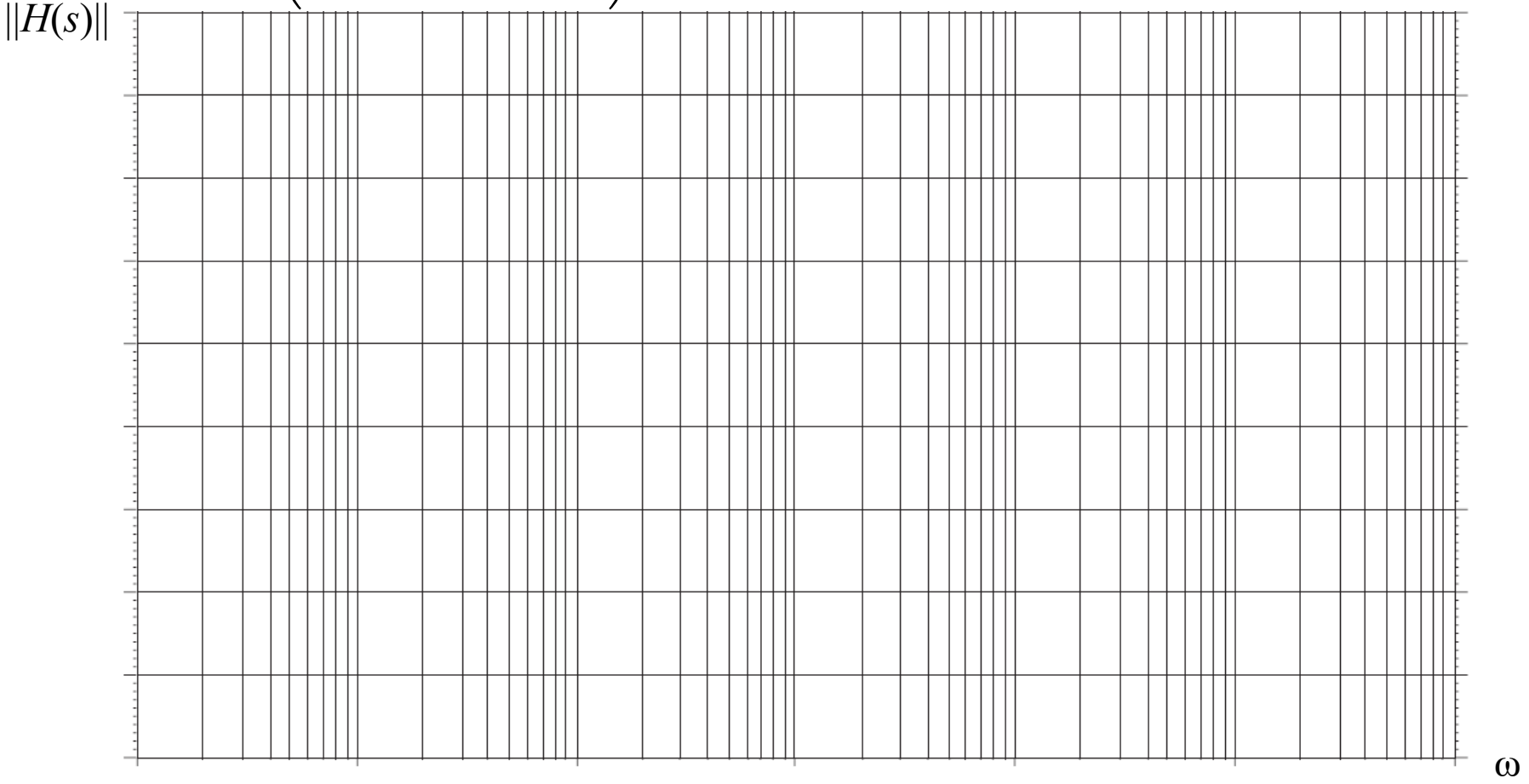
$$H(s) = \frac{A}{s} \frac{\left(1 + \frac{s}{w_{z1}}\right)\left(1 + \frac{s}{w_{z2}}\right)}{\left(\left(\frac{s}{\omega_0}\right)^2 + \frac{s}{Q\omega_0} + 1\right)\left(1 + \frac{s}{\omega_p}\right)}$$



Example

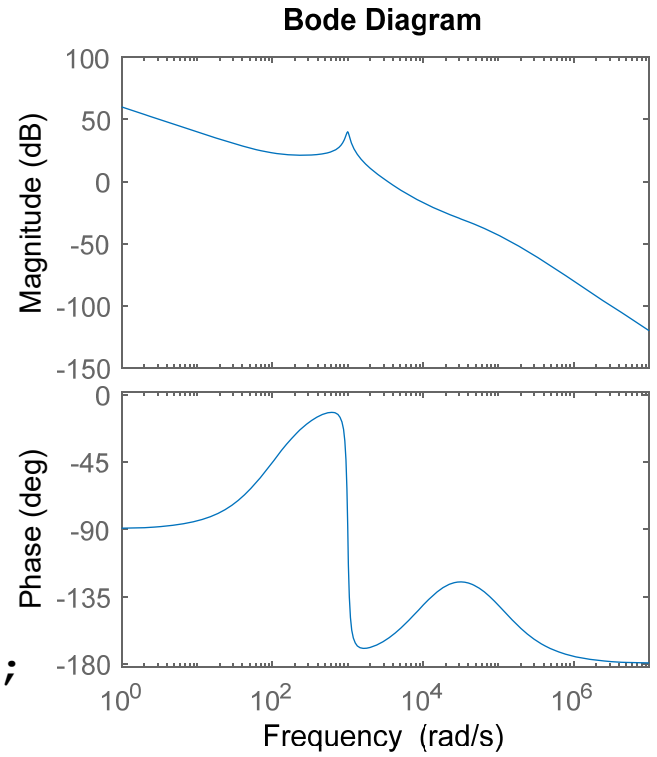
A	w_{z1}	w_{z2}	ω_0	Q	ω_p
1000	100	10k	1k	10	100k

$$H(s) = A\frac{\left(1+\frac{s}{w_{z1}}\right)\left(1+\frac{s}{w_{z2}}\right)}{s\left(\left(\frac{s}{\omega_0}\right)^2+\frac{s}{Q\omega_0}+1\right)\left(1+\frac{s}{\omega_p}\right)}$$



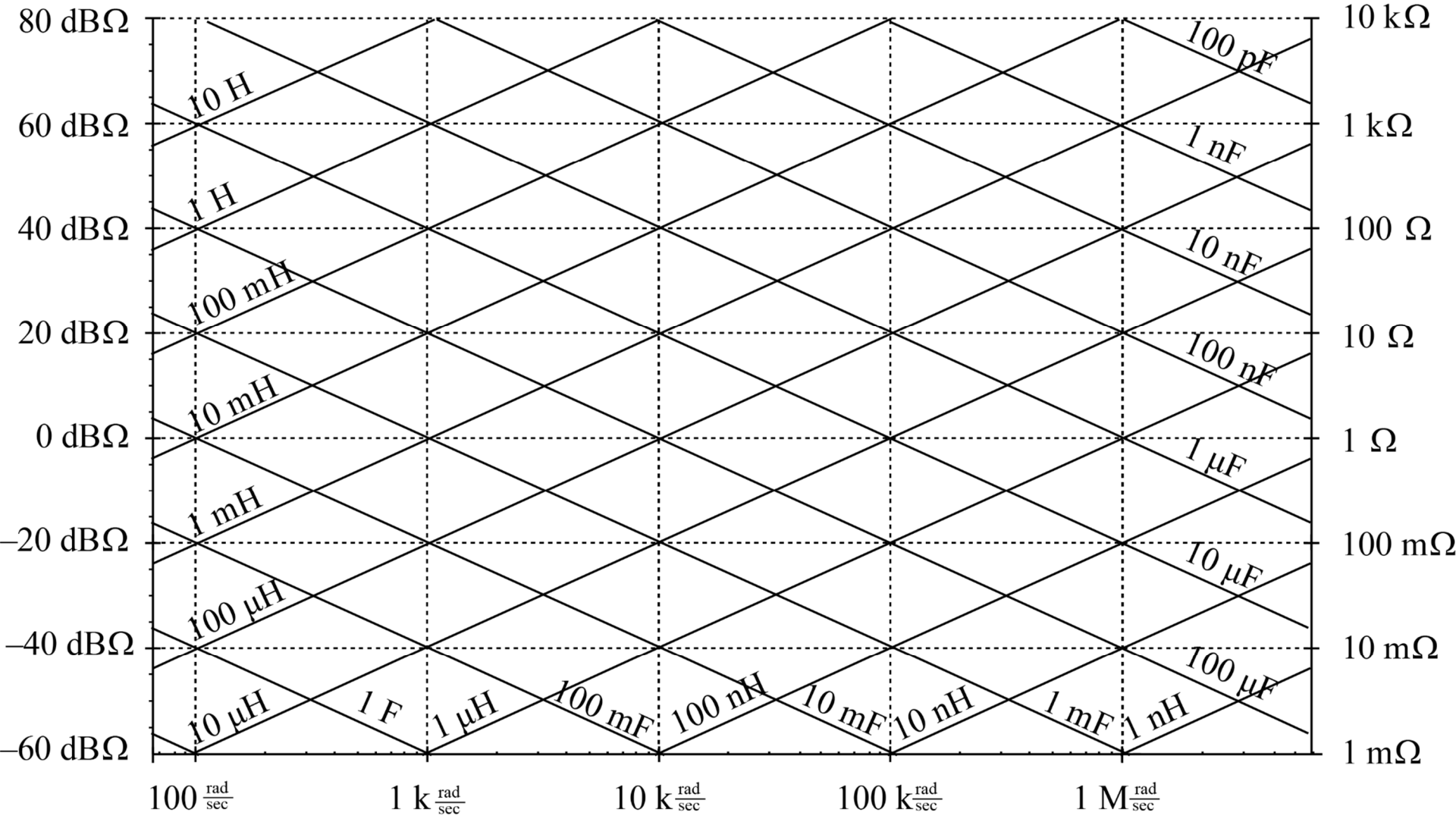
MATLAB

```
A = 1000;
wz1 = 100;
wz2 = 10e3;
w0 = 1e3;
Q = 10;
wp = 100e3;

s = tf('s');

H = A*(1+s/wz1)*(1+s/wz2)/…
        (s*(1+s/wp)*((s/w0)^2+s/Q/w0+1));

bode(H)
```

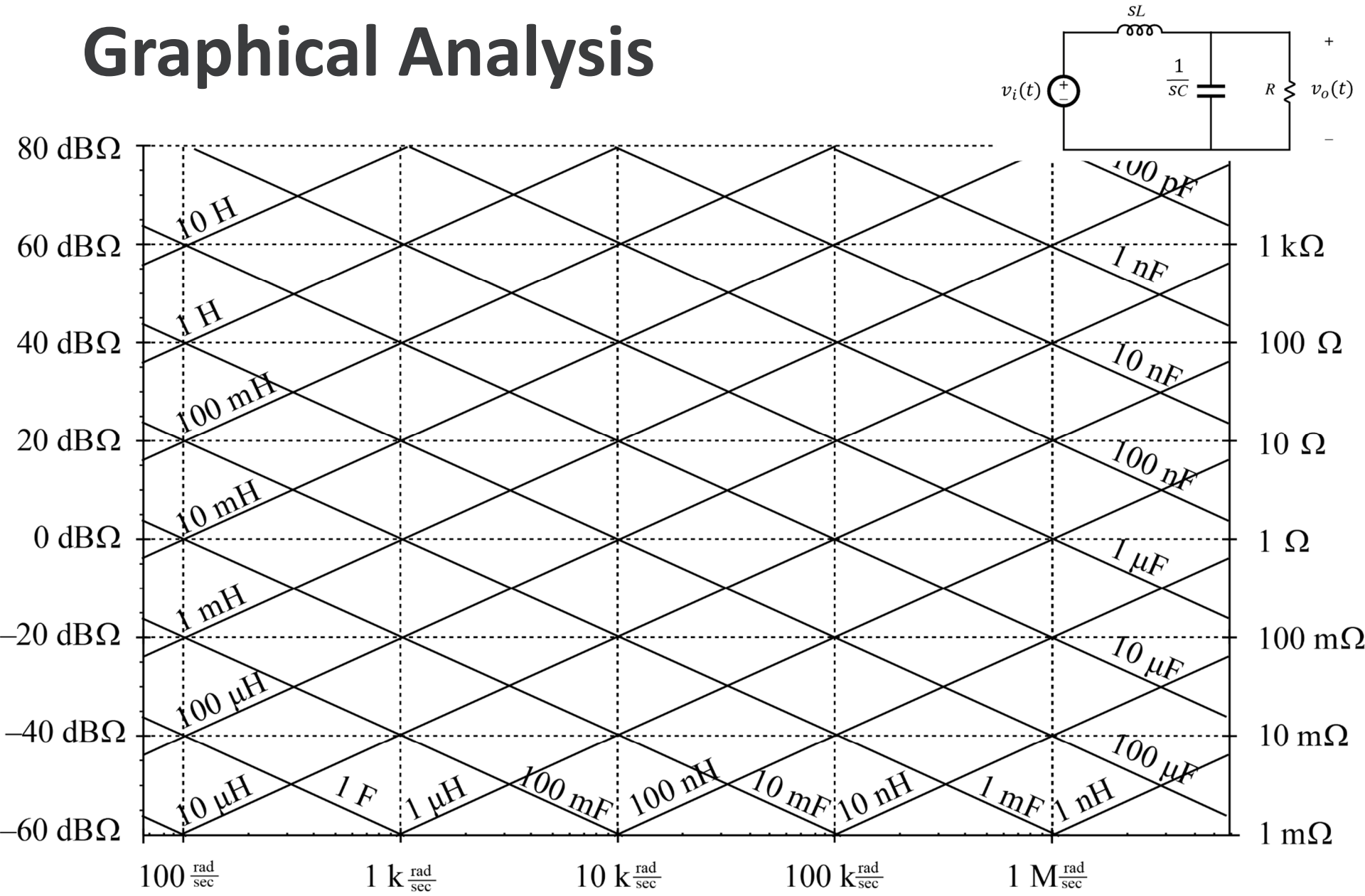


Approximate Graphical Analysis

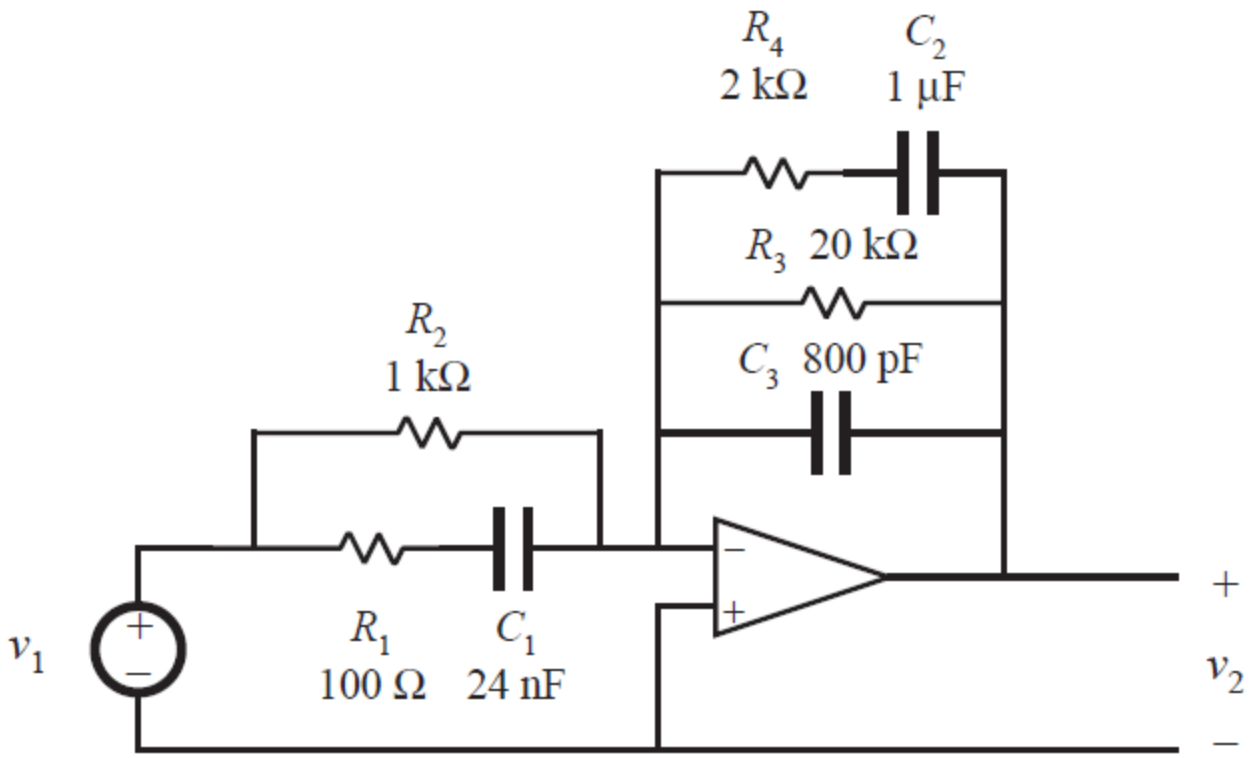
Reactance Paper



Graphical Analysis



Graphical Analysis



Impedance/Reactance Paper