

ELE 215

Linear Circuits Laboratory

Recitation 8

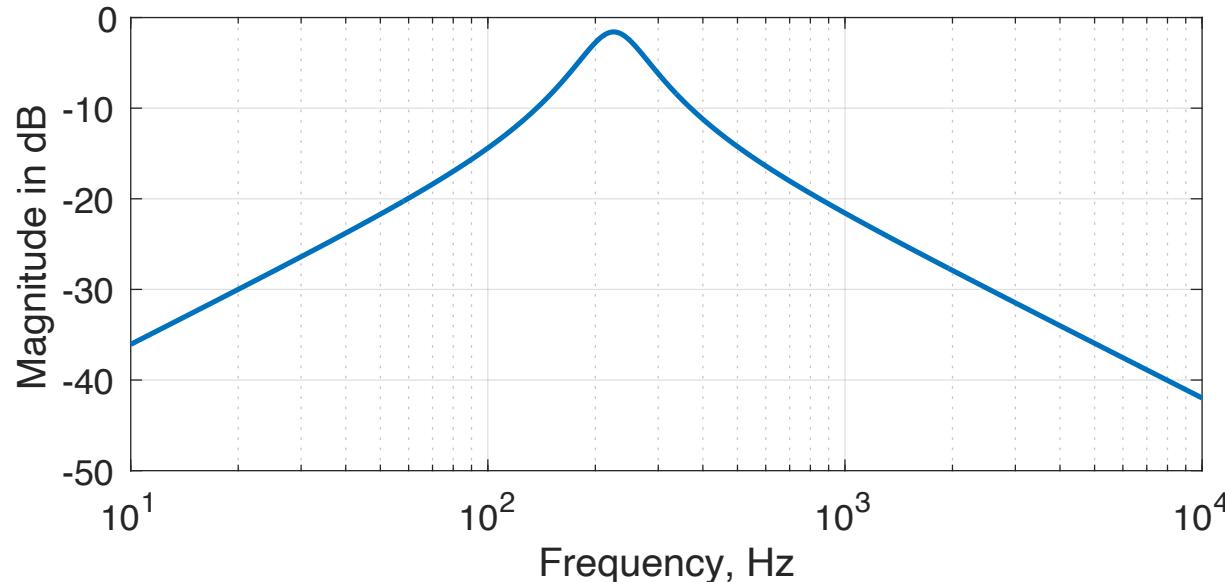
A Bit More on Bode

Good Bode Plots

- 2 stacked plots: magnitude and phase versus frequency
 - Lines for theory
 - Symbols for experimental data (e.g. circles)
- dB scale for magnitude, $20 \log_{10} (\text{abs}(H))$
 - Limit to about 40 dB of range (or less)
- Degrees scale for phase
 - Limit to multiples of 90 as needed
- Frequency on a log base 10 scale (e.g. semilogx in MatLab)
 - Limit to range with “interesting” curves
- Clear annotations with large fonts

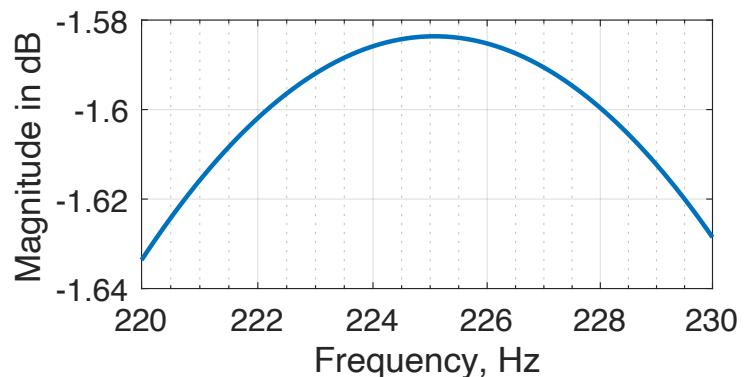
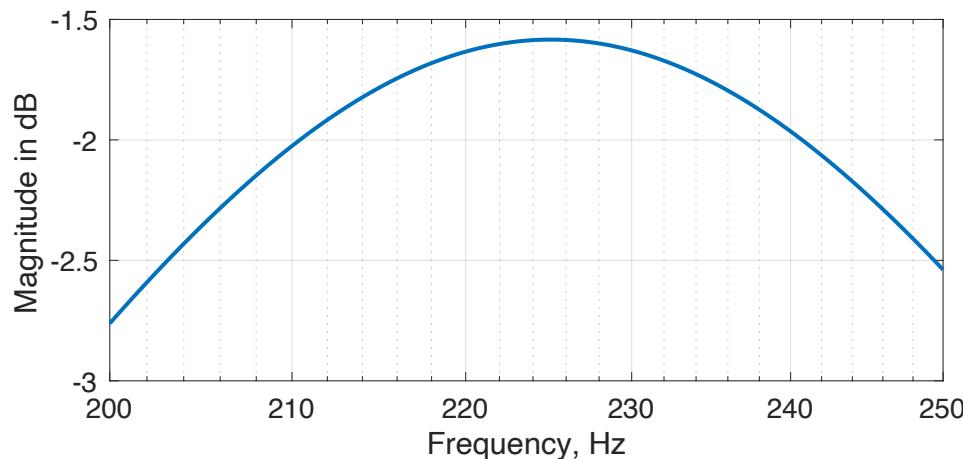
Characterizing a Filter

- Imagine this Bode magnitude response



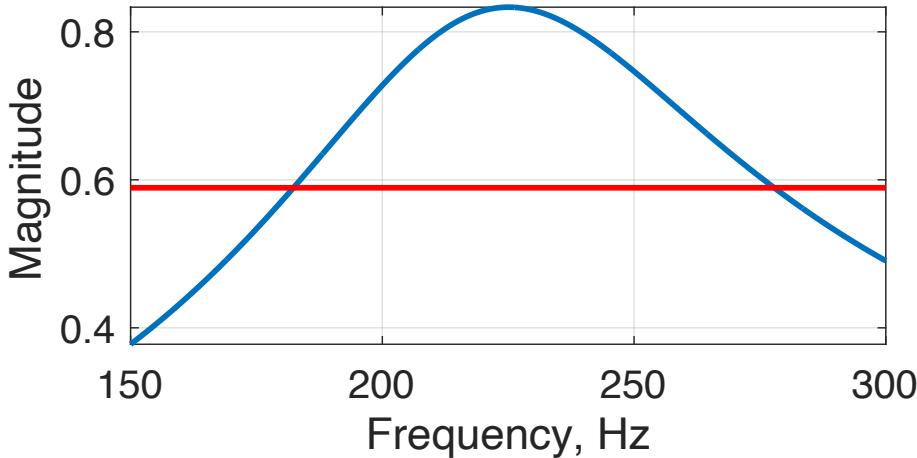
- How can we describe this BPF?
 - Location of peak in Hz
 - Height of peak
 - Width of peak

- The peak:
 - Zoom in, perhaps using linspace for f and plotting with a linear frequency axis

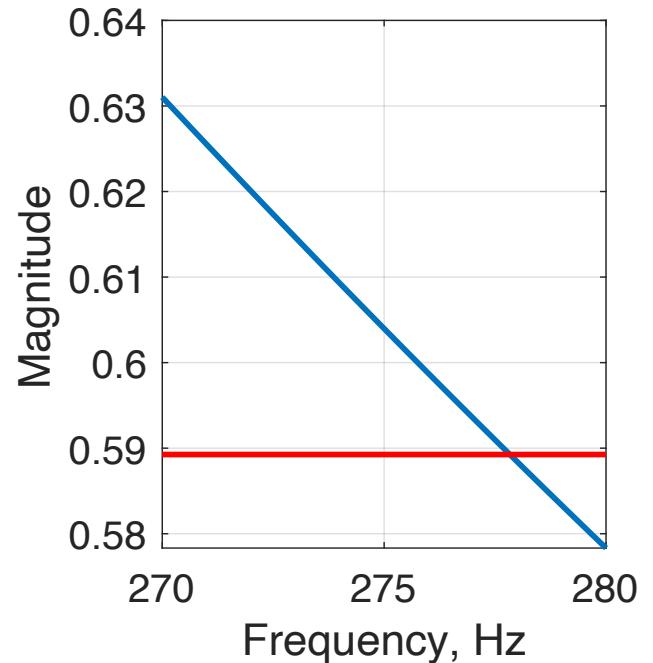
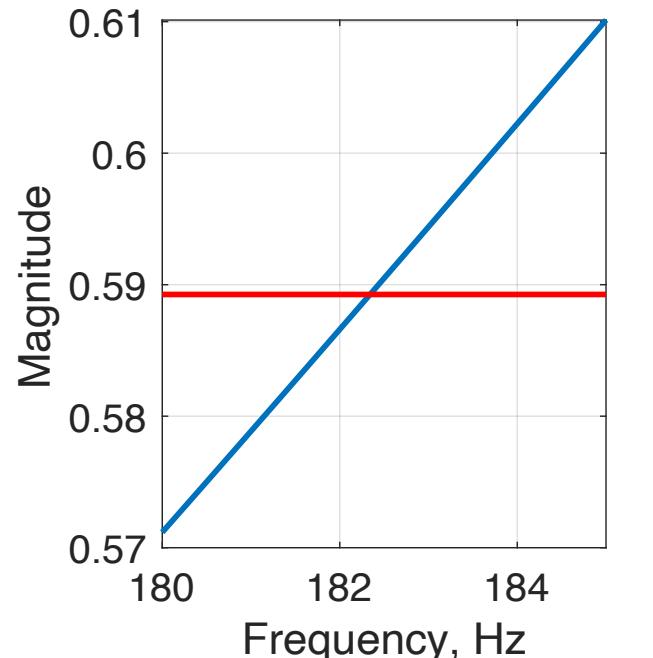


- Peak of about **-1.58 dB** at about $f_c = 225 \text{ Hz}$

- Width – use the “3 dB” bandwidth:
 - Looking for $-4.58 \text{ dB} \approx 0.590$
 - Plot on linear axis; zoom in

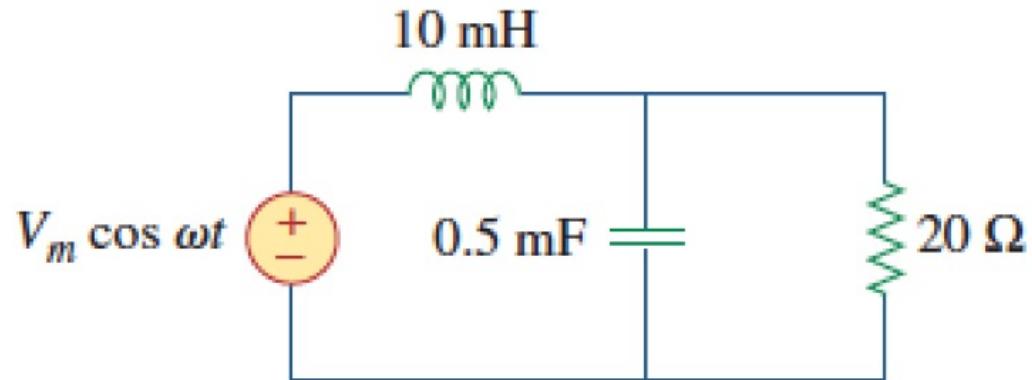


- Band is 182 to 278 Hz
- 3 dB BW = 96 Hz**

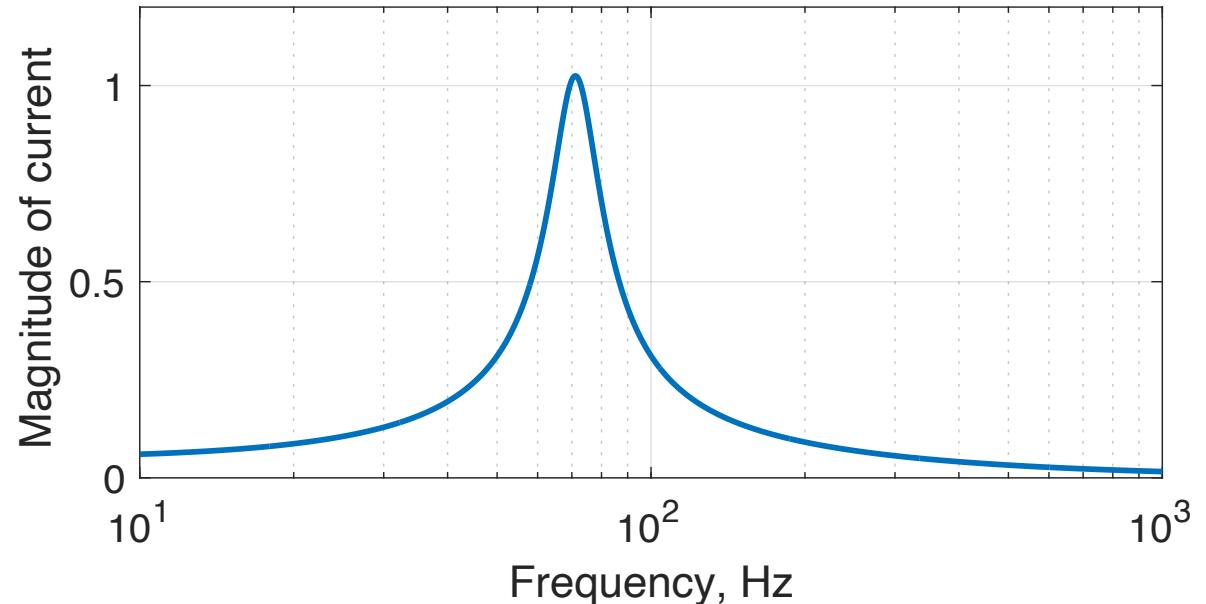
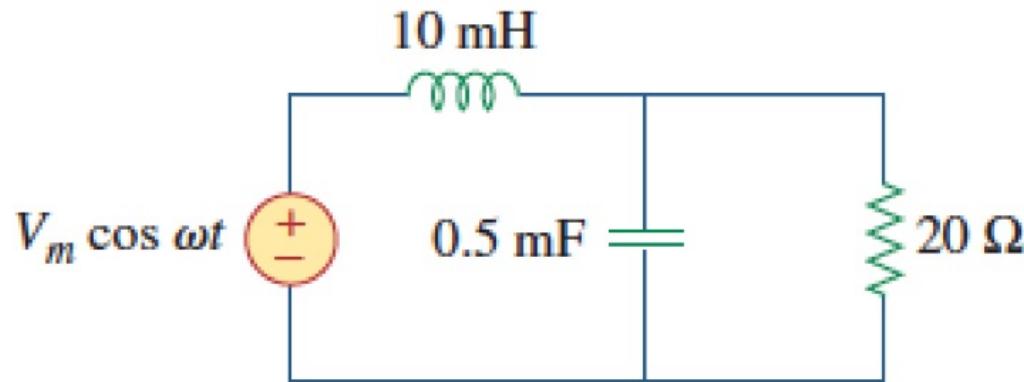


Resonance

- Example of resonance



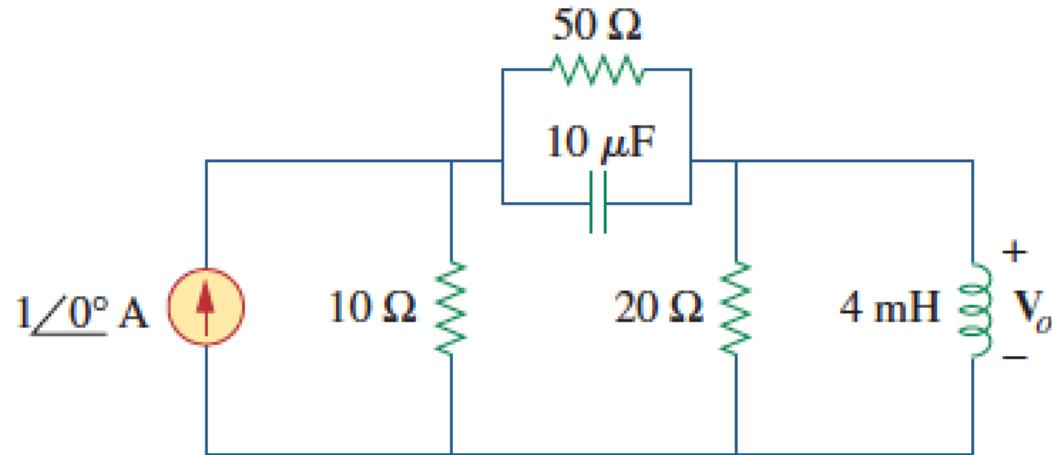
- What does this circuit do?
 - Let's consider the current in the inductor (left to right)



```
f = logspace(0,5);
om = 2*pi*f;
ZL = 1j.*om*10e-3;
ZC = -1j./om/.5e-3;
ZP = 20*ZC./(20+ZC);
H = 1./(ZL+ZP);
semilogx(f,abs(H), 'linewidth', 2)
```

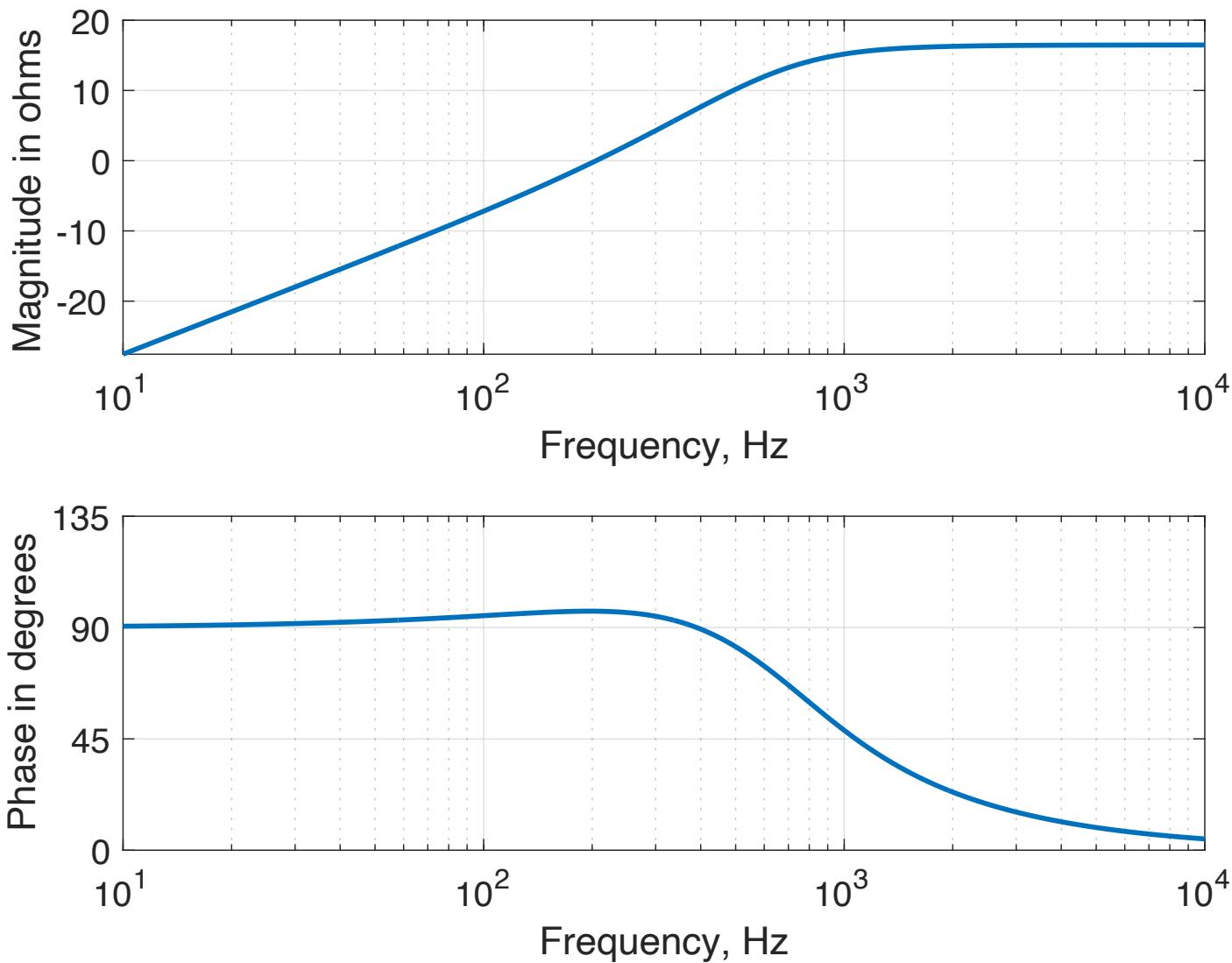
Usually very narrow,
high Q

Bode Example using Node Analysis



```
f = logspace(0,8,500);
om = 2*pi*f;
for k = 1:500
    z = 1/50+1j*om(k)*1e-5;
    A = [ 1/10+z, -z; -z, z+1/20+1/(1j*om(k)*4e-3) ];
    b = [ 1 ; 0 ];
    v = A\b;
    V(k) = v(2);
end
figure(1)
subplot(211)
semilogx(f,20*log10(abs(V)),'linewidth',2)
subplot(212)
semilogx(f,180/pi*angle(V),'linewidth',2)
```

- Refine



(A Few Words on) Teamwork

- The collaborative effort of a group to achieve a common goal or to complete a task in an effective and efficient way
- More than just multiple people working on independent tasks for time efficiency
- Pros: better results (**accuracy**), project resiliency (**continuity**) , self checking (**integrity**), mentoring, more fun
- Cons: workload balance, potential conflicts
- Skills:
 - Communication (listening, observing, giving feedback)
 - Participation (providing knowledge, attitude)
 - Responsibility (monitor goals and progress)

- Don't be put off by buzzwords:
 - "timekeeper", "facilitator", "scribe", "reporter"
- Personal experience
 - "young" guy – multi-year, hands-on experience; computer skills; good at presentation materials
 - "old" guy – big picture, outside info resource, strong intuition, contact list, historical context
 - Me – math skills, algorithm development, experiment planning, graphical presentation and writing skills

Specifics for week after break

- Continue work on Exercise 1; Exercise 3 is due on Monday March 23 at 9 AM
- Prelab 6 for 9 AM Monday March 23 – 20 points
 - Theoretical characteristics of your BPF; expected Bode plot
 - Instructions posted on ELE 215 website
- Lab 6 – 80 points (pairs):
 - Instructions posted on ELE 215 website
 - Summary sheets available in lab rooms and on website
 - Due by 5 PM Wednesday April 1