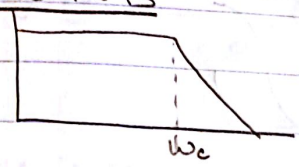
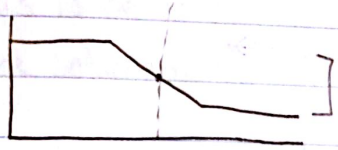
Discussion #9

- Bode plots & review of phase
- Importance of phase
  - w/ multiple signals
- Stacking filters

Bode Plots



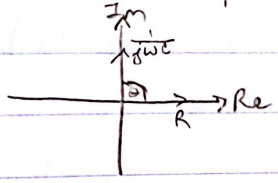
for each corner freq



90° phase shift

Where does 90° come from?

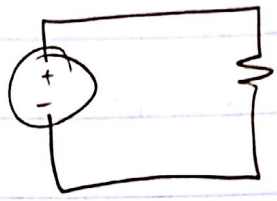
Recall the Re-Im plot

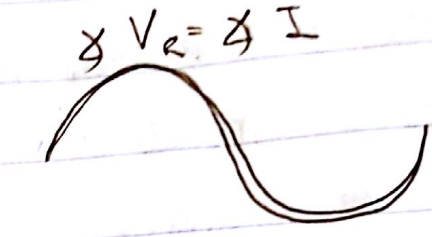


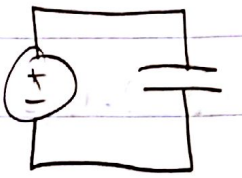
Some impedance R & $\frac{1}{j\omega C}$

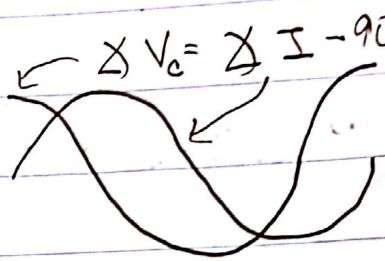
Phase is θ from the origin. We can immediately see that R has $\theta = 0$ & $\frac{1}{j\omega C}$ has $\theta = -90°$.

Because capacitors don't like voltage changing & pull a lot of current to stop voltage changing, they cause I & V to get out of alignment ⇐ phase

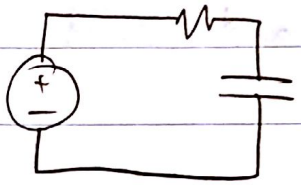


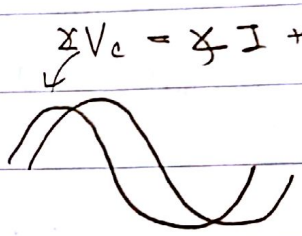






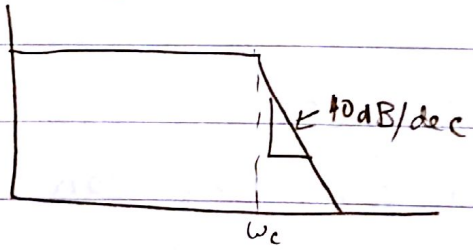
Vc lags I

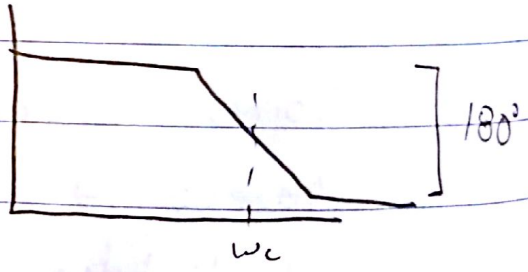


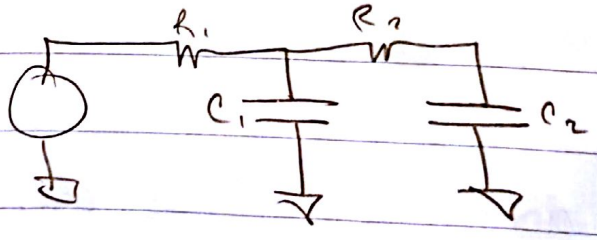


phase calculated as $\tan^{-1}\left(\frac{Z_c}{R}\right)$

Recall last week when we talked about making sharper filters



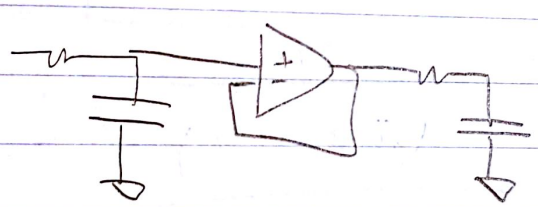




Turns out choosing an R_1 & R_2 & C_1 & C_2 to get that ω_c in the same place is very tricky

$$H(s) = \frac{1}{s^2 R_1 R_2 C_1 C_2 + s[R_1(C_1 - C_2) + R_2 C_2] + 1}$$

This is because the two capacitors are interacting. How to make that stop?



Now, $H(s) = (\text{normal RC})^2 = \frac{1}{(sRC+1)^2}$