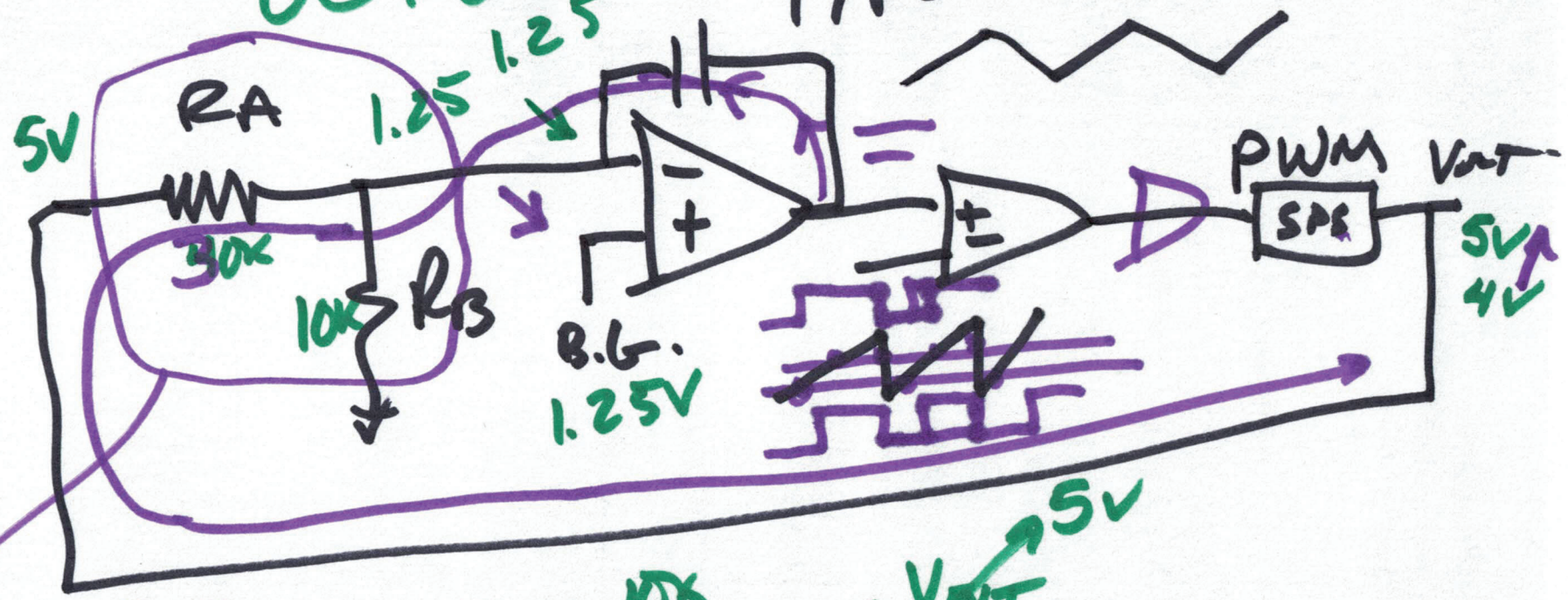
EE 442 Power Elec.

Lecture 12

October 12, 2022



$$\beta = \frac{R_B}{R_A + R_B} \quad 1.25 = \frac{10K}{10K + 30K} \cdot V_{OUT} \quad 5V$$

$$A_{CL} = \frac{A_{OL}}{1 + \beta A_{OL}} = \frac{V_{OUT}}{V_{IN}} = \frac{1}{\frac{1}{A_{OL}} + \frac{R_B}{R_A + R_B}\beta}$$

$A_{OL} \to \infty$

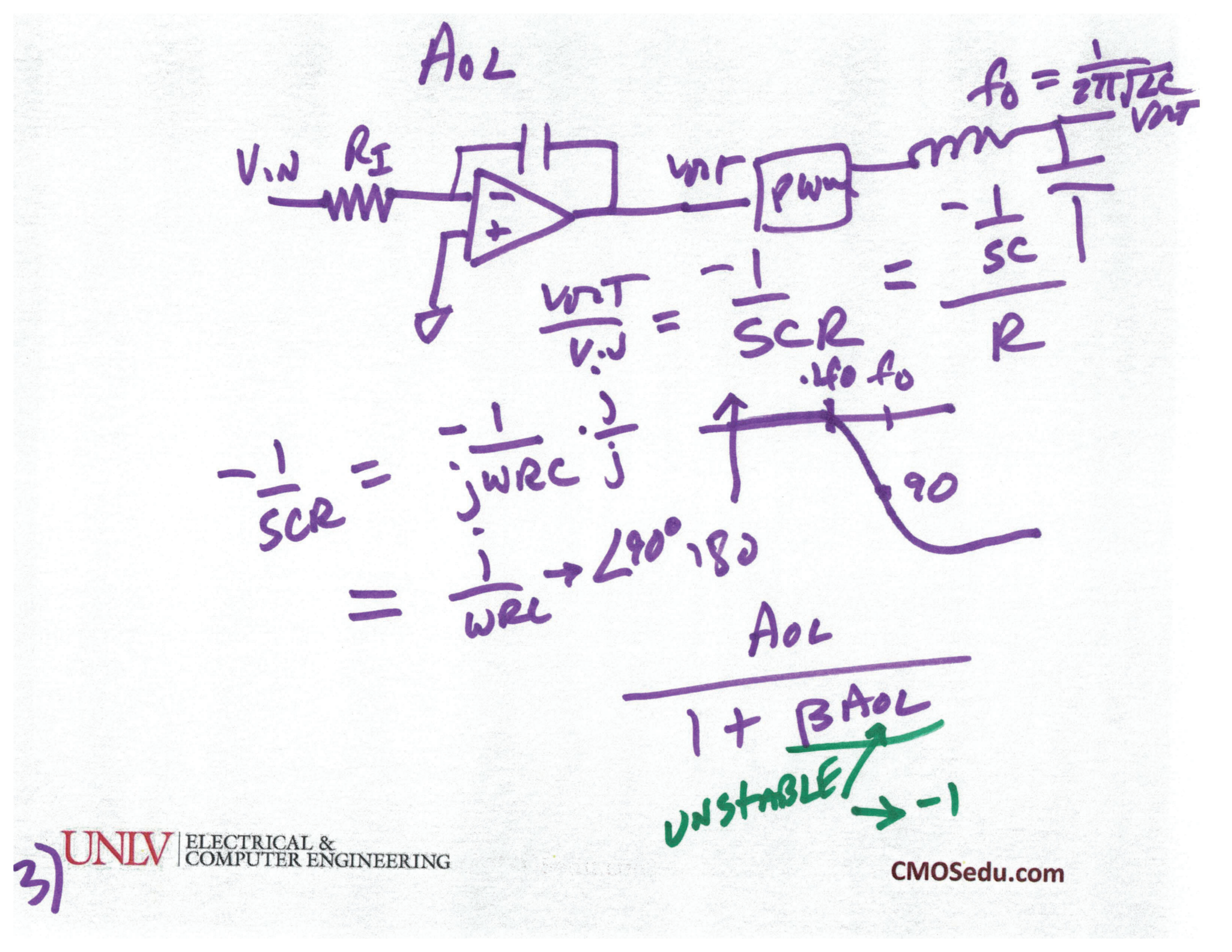
$$A_{CL} = \frac{V_{OUT}}{V_{IN}} = \frac{1}{\beta}$$

$$= \frac{R_A + R_B}{R_B} = \frac{390K + 10K}{10K}$$

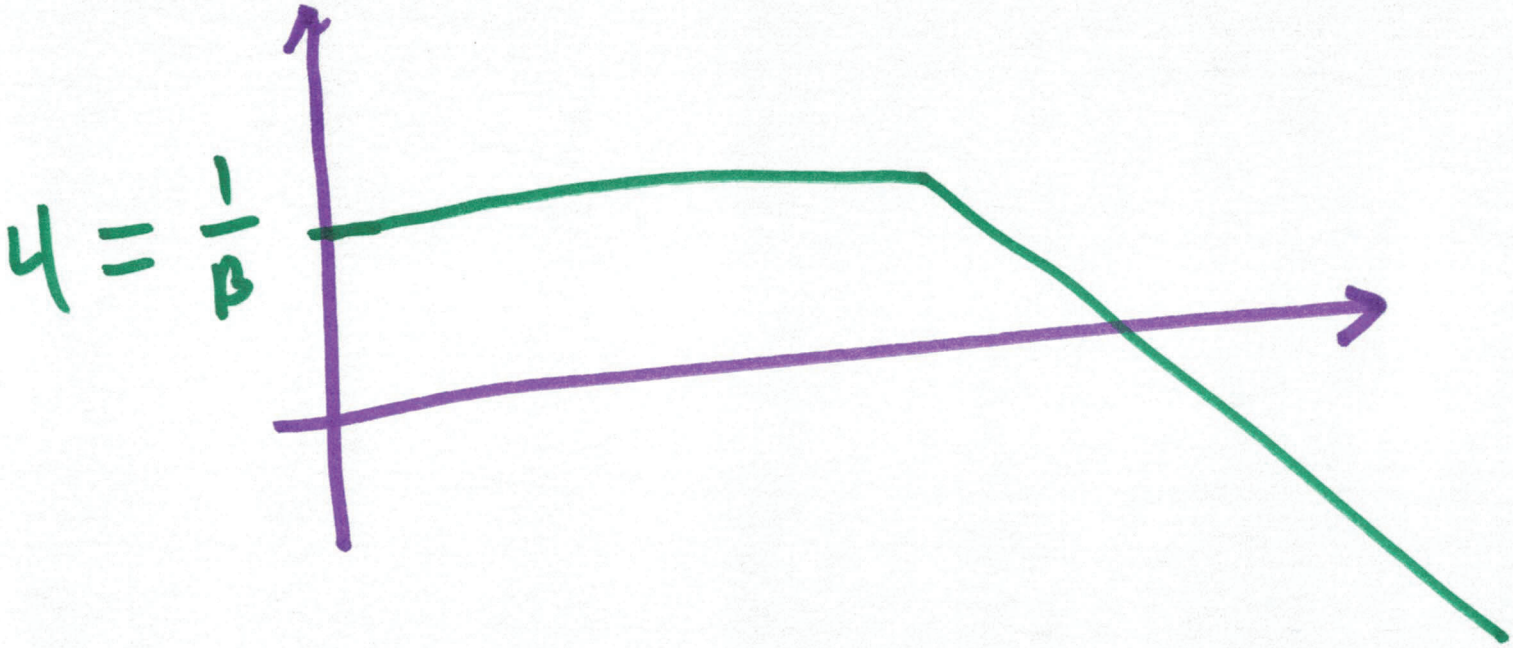
$$A_{CL} = 54$$

$$V_{OUT} = V_{IN} \cdot A_{CL}$$

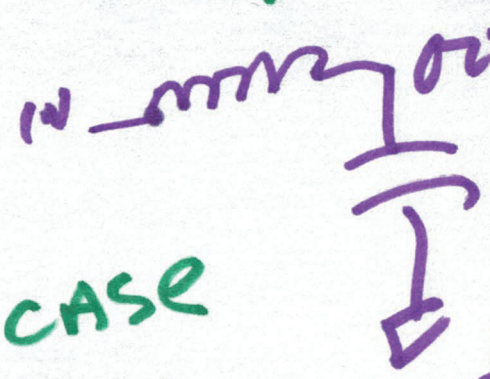
$$= 1.25V \cdot 4 = 5V$$



$$A_{CL} = \frac{\frac{1}{sCR}}{1 + \beta \cdot \frac{1}{sCR}} = \frac{1}{\beta} \cdot \frac{1}{\frac{sCR}{\beta} + 1}$$



Loop Gain = βA_{OL}



$\beta A_{OL} = -1$

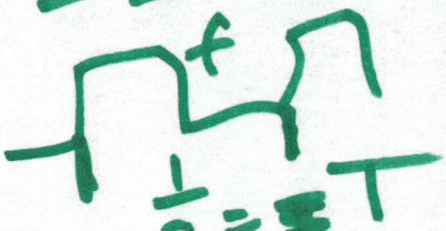
$|\beta A_{OL}| = 1$

$\angle \beta A_{OL} = \pm 180$

WORST CASE

$\beta = 1$

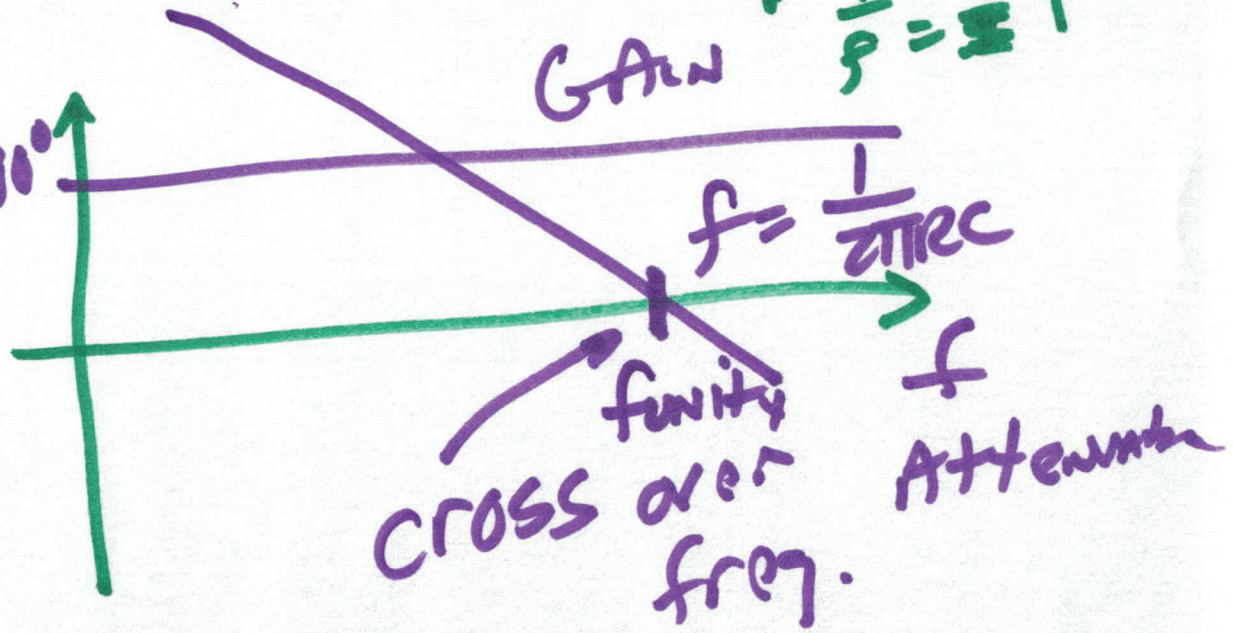
$f_0 = \frac{1}{2\pi RC}$

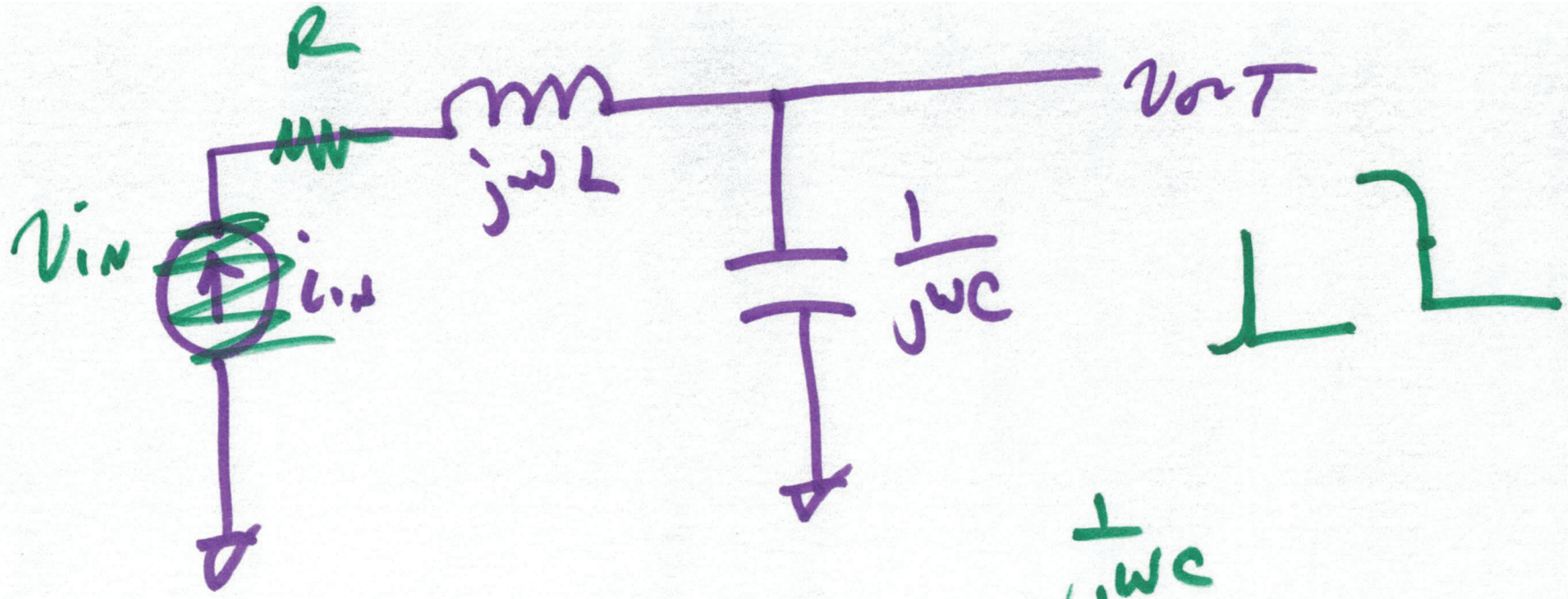


$|A_{OL}| = \left|\frac{1}{SRC}\right|$

$1 = \left|\frac{1}{SRC}\right|$

$1 = \left|\frac{1}{j\omega RC}\right|$





$$V_{OUT} = V_{in} \cdot \frac{\frac{1}{j\omega C}}{\frac{1}{j\omega C} + R + j\omega L}$$

$$\frac{V_{OUT}}{V_{in}} = \frac{1}{1 + j\omega RC + s^2 LC}$$

$$\frac{V_{out}}{V_{in}} = \frac{\frac{1}{LC}}{s^2 + s\frac{R}{L} + \frac{1}{LC}}$$

$$s = \frac{-\frac{R}{L} \pm \sqrt{\left(\frac{R}{L}\right)^2 - 4 \cdot \frac{1}{LC}}}{2}$$

$R \to 0$

$$s = \frac{1}{\sqrt{LC}} \cdot \pm j$$

$$j\omega = \frac{1}{\sqrt{LC}} \pm j$$

$$f_0 = \frac{\pm 1}{2\pi\sqrt{LC}}$$