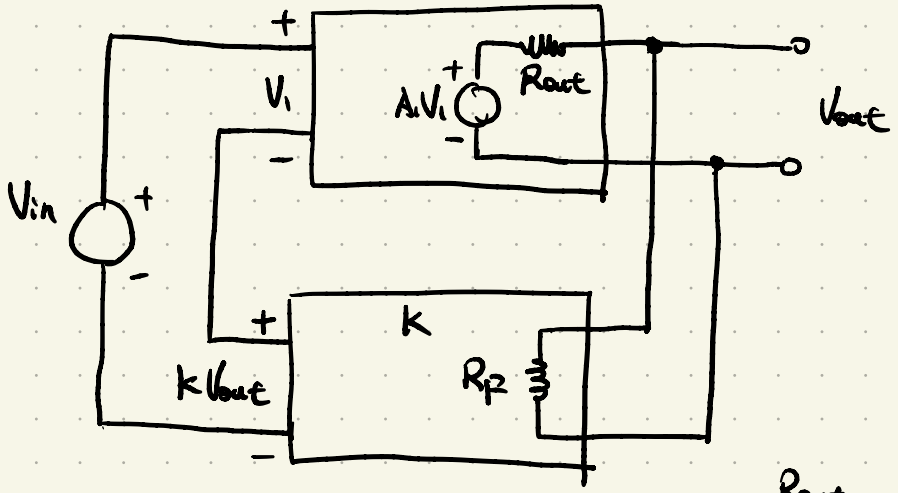
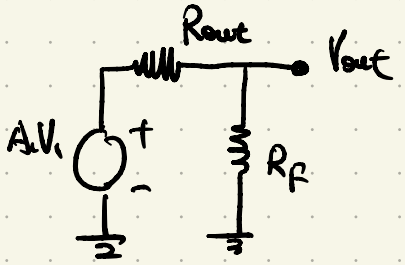
Lec 41

- Accurate Analysis of Feedback Circuits
  - Opening the loop properly
  - Calculation of Feedback Factor

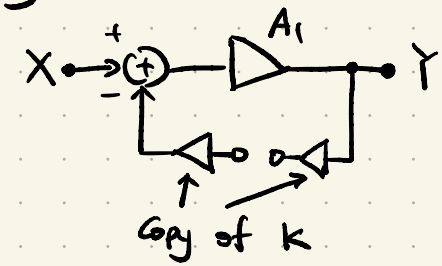
Illustrative Example



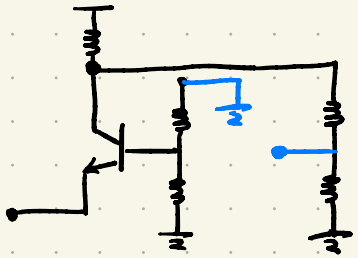


$$(V_{in} - kV_{out}) A_1 \frac{R_{F2}}{R_F + R_{out}} = V_{out}$$

Opening the Loop Properly



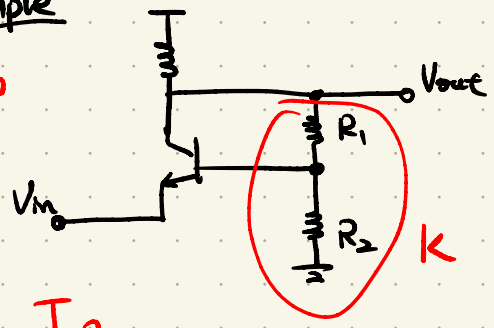
Example



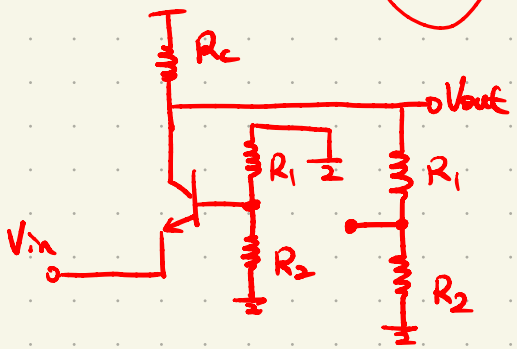
Voltage - Voltage	Open
Voltage - Current	
Current - Voltage	
Current - Current	

Example

$V_A = \infty$



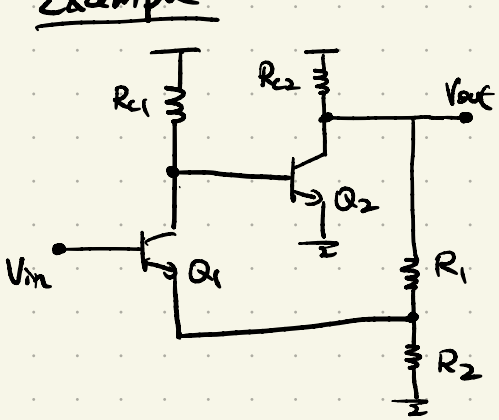
$R_{out} \simeq R_C // (R_1 + R_2)$

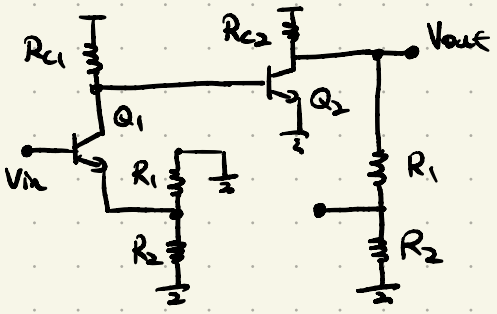


$A_1 \simeq g_m [R_C // (R_1 + R_2)]$

$R_{in} = \frac{1}{g_m} + \frac{R_1 // R_2}{1+\beta}$

Example





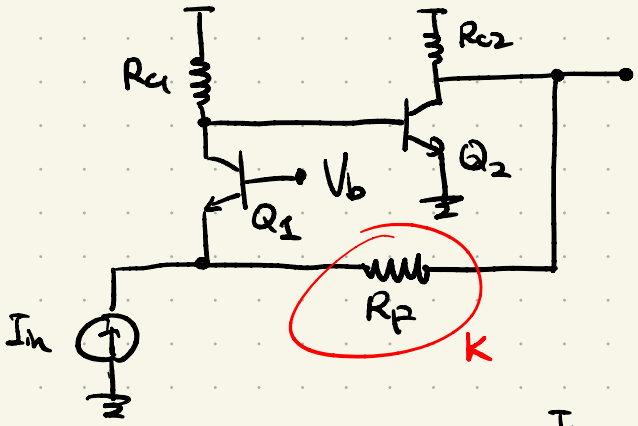
Open-Loop Gain:

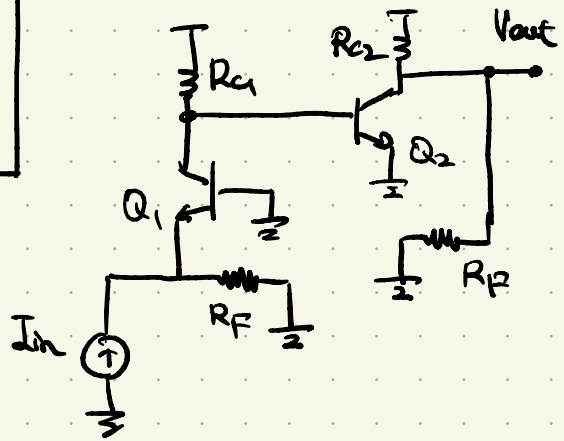
$$\frac{V_{out}}{V_x}\cdot\frac{V_x}{V_{in}} = \left\{-g_{m2}\left[R_{C2}\,//\,(R_1+R_2)\right]\right\} \times \frac{-(R_{C1}\,//\,r_{\pi 2})}{\frac{1}{g_{m1}}+(R_1\,//\,R_2)}$$

Open-Loop Input Imp. $= r_{\pi 1} + (R_1\,//\,R_2)(\beta+1)$

Open-Loop Output Imp. $= R_{C2}\,//\,(R_1+R_2)$

Example





Open-Loop Calculations:

$$\text{Gain: } \frac{V_{out}}{I_{in}} = \frac{V_x}{I_{in}}\cdot\frac{V_{out}}{V_x}$$

$$= \left[\frac{I_{in}\cdot R_F}{R_F+\frac{1}{g_m}}\cdot(R_{C1}\,//\,r_{\pi 2})\right] \times -g_{m2}\cdot(R_{C2}\,//\,R_F)$$

Input Imp. $R_{in} = \frac{1}{g_{m1}}\,//\,R_F$

Output Imp. $R_{out} = R_{C2}\,//\,R_F$

Example