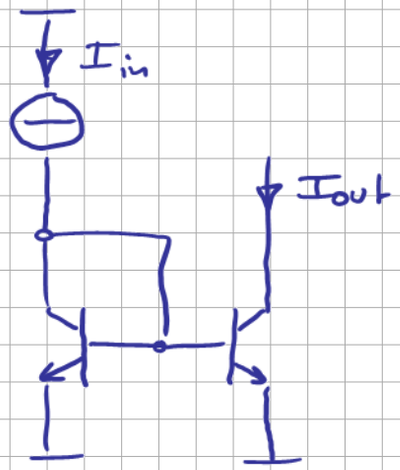
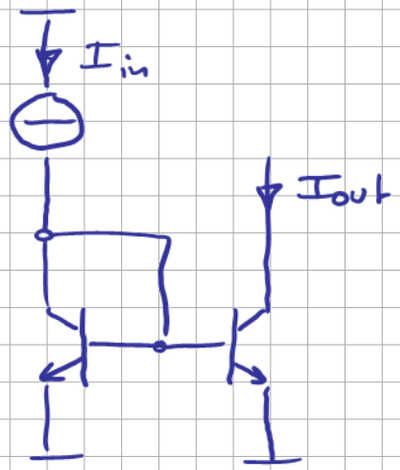
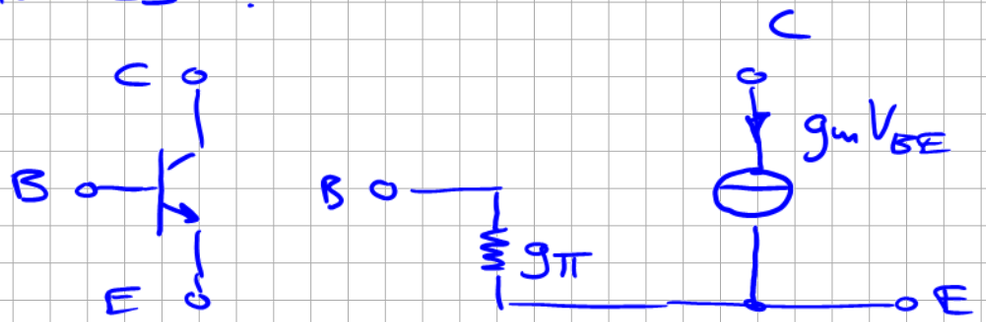
Bipolar current mirror



Bipolar current mirror

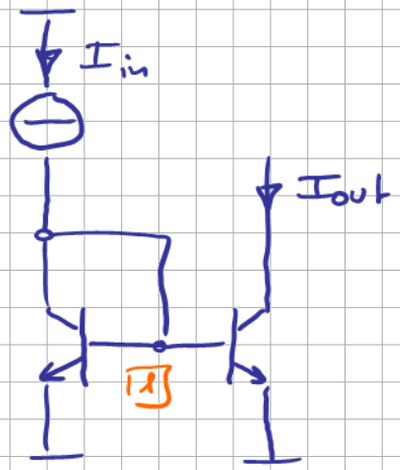


Small-signal hybrid-π model of the BJT:



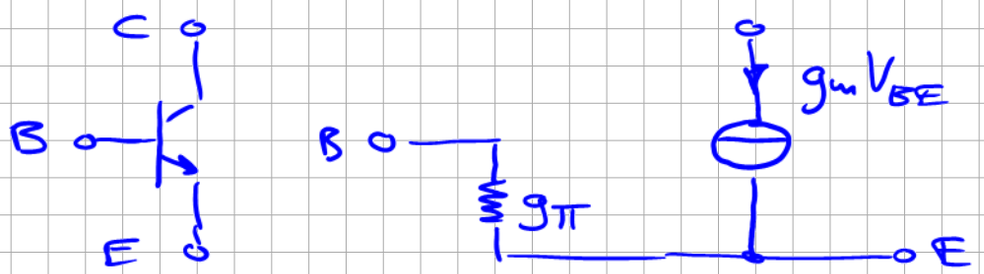
with $g_\pi = \frac{1}{\beta} \cdot g_m$

Bipolar current mirror



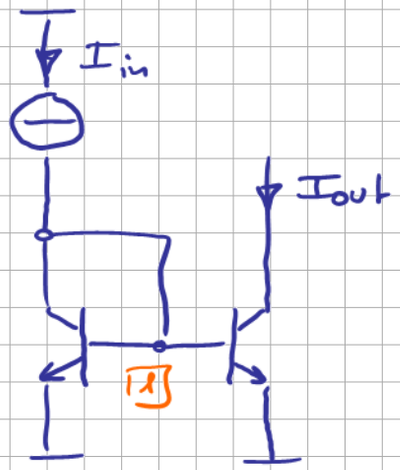
$$y_1 = \frac{1}{z_1} = g_m + 2g_\pi$$

Small-signal hybrid-π model of the BJT:



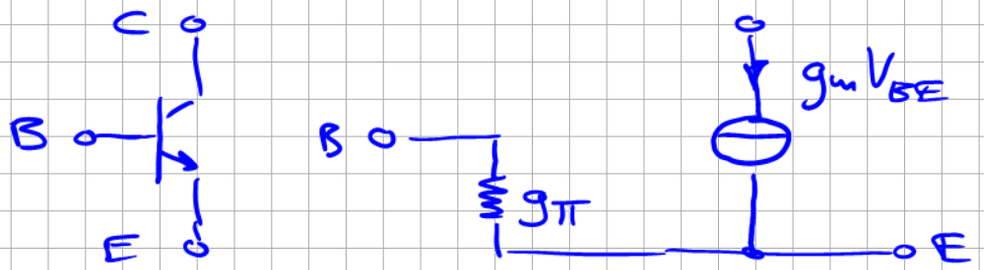
with $g_\pi = \frac{1}{\beta} \cdot g_m$

Bipolar current mirror



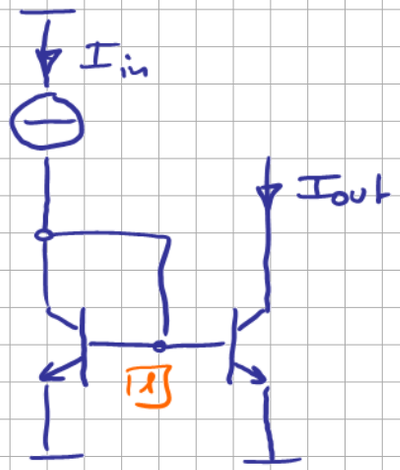
$$y_1 = \frac{1}{z_1} = g_m + 2g_\pi$$

Small-signal hybrid-π model of the BJT:



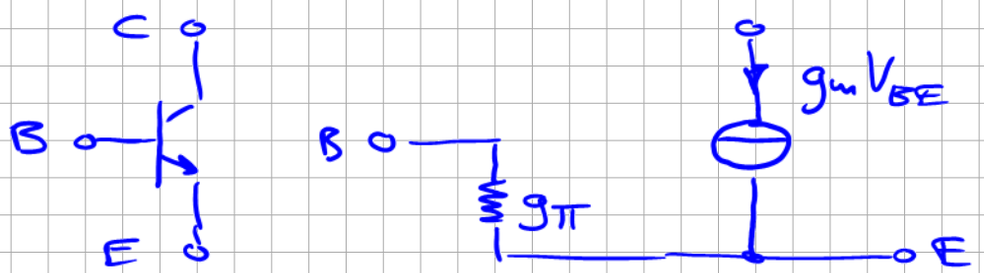
with $g_\pi = \frac{1}{\beta} \cdot g_m$

Bipolar current mirror



$$y_1 = \frac{1}{z_1} = g_m + 2g_\pi$$

Small-signal hybrid-π model of the BJT:



with $g_\pi = \frac{1}{\beta} \cdot g_m$

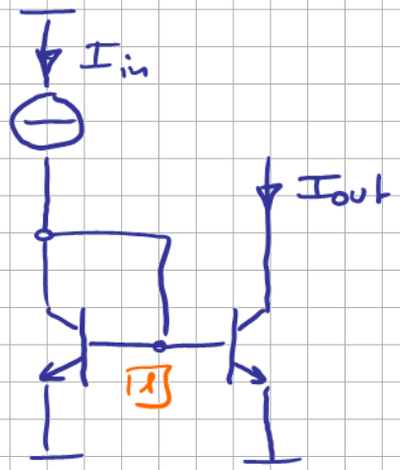
$$T = \frac{I_{out}}{I_{in}} = z_1 g_m = \frac{g_m}{g_m + 2g_\pi} = \frac{g_m}{g_m\left(1 + \frac{2}{\beta}\right)} = \frac{\beta}{\beta + 2}$$

For example, $\beta = 100 \longrightarrow T \approx 0.98$

Hanspeter Schmid, FHNW/ISE, 11/2018

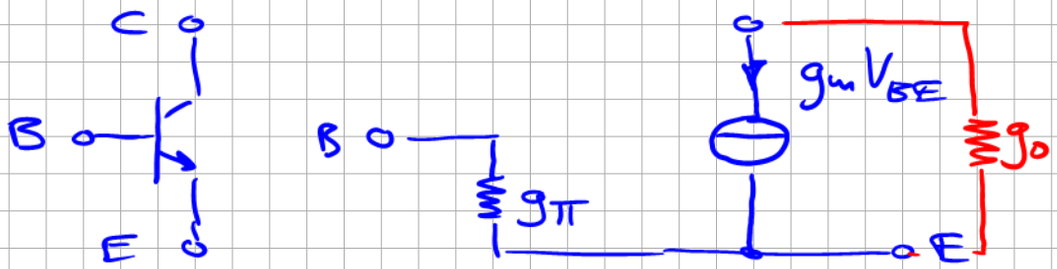
Bipolar current mirror

Effect of output conductance



$$y_1 = \frac{1}{z_1} = g_m + 2g_\pi + g_o$$

Small-signal hybrid-π model of the BJT:



with $g_\pi = \frac{1}{\beta} \cdot g_m$

$$T = \frac{I_{out}}{I_{in}} = z_1 g_m = \frac{g_m}{g_m + 2g_\pi + g_o} = \frac{g_m}{g_m\left(1 + \frac{2}{\beta}\right) + g_o/g_m} = \frac{\beta}{\beta + 2 + g_o/g_m}$$

For example, $\beta = 100 \longrightarrow T \approx 0.98$

If $g_m \gg g_o$, nothing really changes.

Hanspeter Schmid, FHNW/ISE, 11/2018