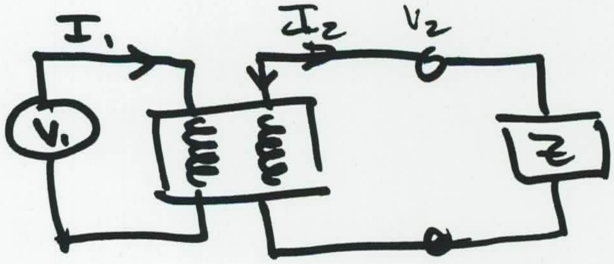
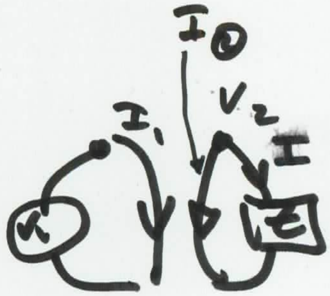
TRANFORMERS and GYRATORS

Transformer:





What is the driving point impedance

$$Z_1 = \frac{V_1}{I_1} \quad ?$$

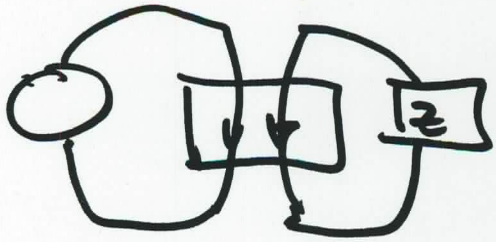
Def : Transformer : $\begin{cases} V_1 = TF \cdot V_2 \\ I_1 = \frac{1}{TF} \cdot I_2 \end{cases}$ since $I_0 = -I_2$

so $$Z_1 = \frac{V_1}{I_1} = \frac{TF \cdot V_2}{\frac{1}{TF} I_2} = (TF)^2 \frac{V_2}{I_2} = (TF)^2 \cdot Z$$

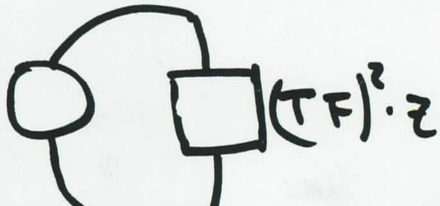
so the equivalent impedance is

$$Z_1 = (TF)^2 \cdot Z$$

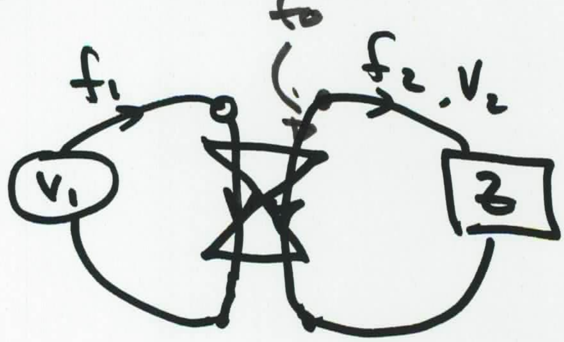
so



can be replaced by



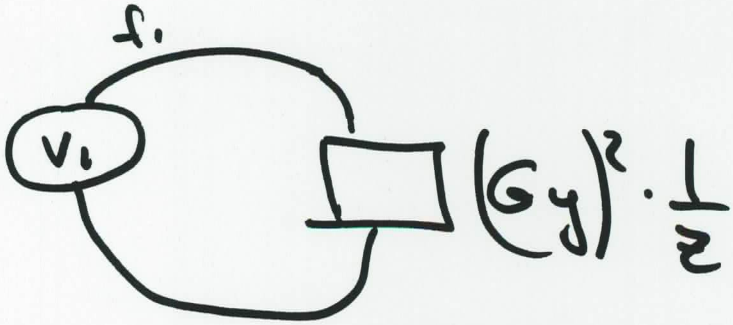
Gyrator



since $f_0 = -f_2$

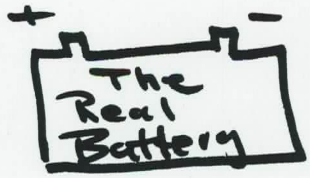
$$\begin{cases} V_1 = G_y \cdot f_2 \\ f_1 = +\frac{1}{G_y} \cdot V_2 \end{cases} \Rightarrow Z_1 = \frac{V_1}{f_1} = (G_y)^2 \cdot \frac{1}{Z}$$

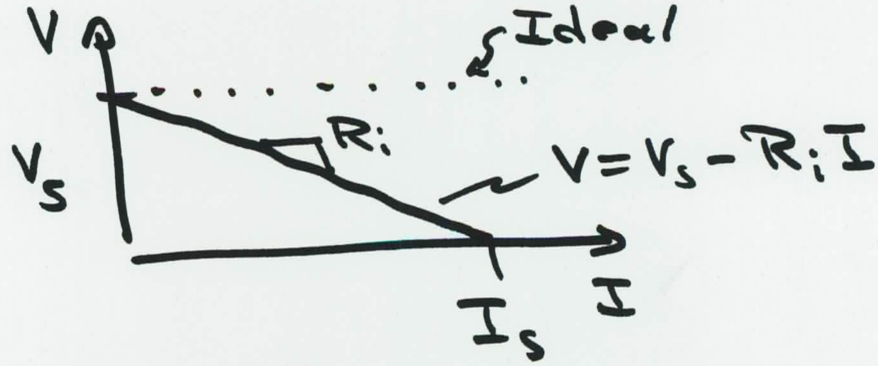
so a gyrator can be replaced by



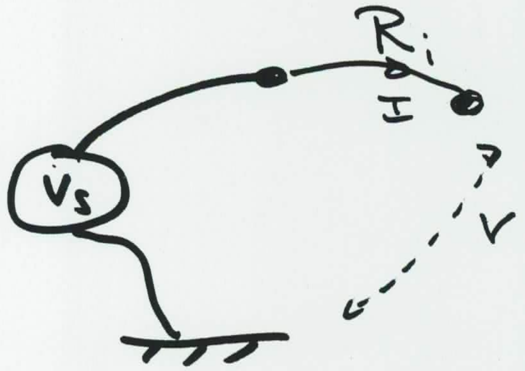
Source Representation

- The Real Battery

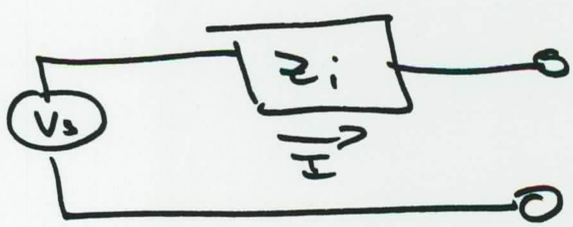




Linear Graph:



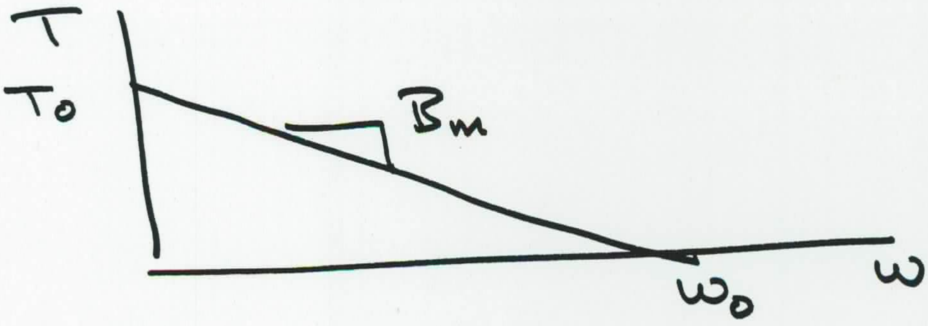
Loop $\quad V_s = R_i I + V \Rightarrow V = V_s - I R_i$ ← Actual Battery Voltage.



$V = V_s - Z_i I$

A Thevinin source representation

Electric Motor

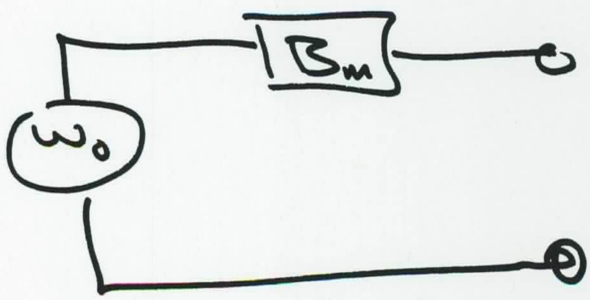


T_o - stall torque

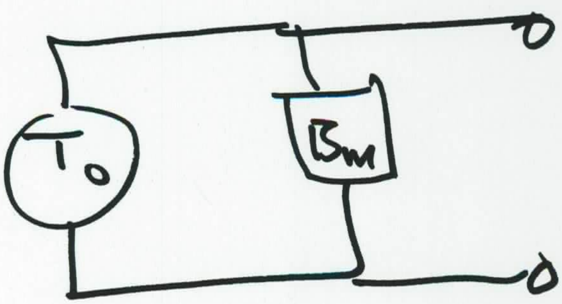
ω_o - free running speed

$$T = T_o - \left(\frac{T_o}{\omega_o}\right) \cdot \omega = T - B_m \cdot \omega$$

$$B_m = \text{internal damping} = \frac{T_o}{\omega_o}$$



Thevenin



Norton