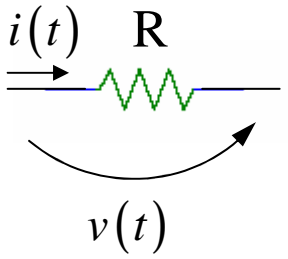
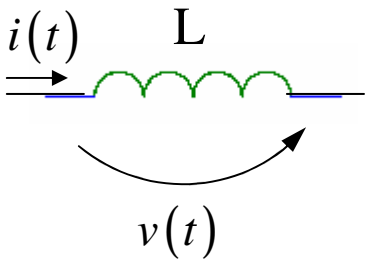
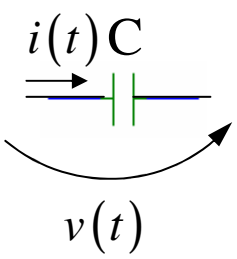
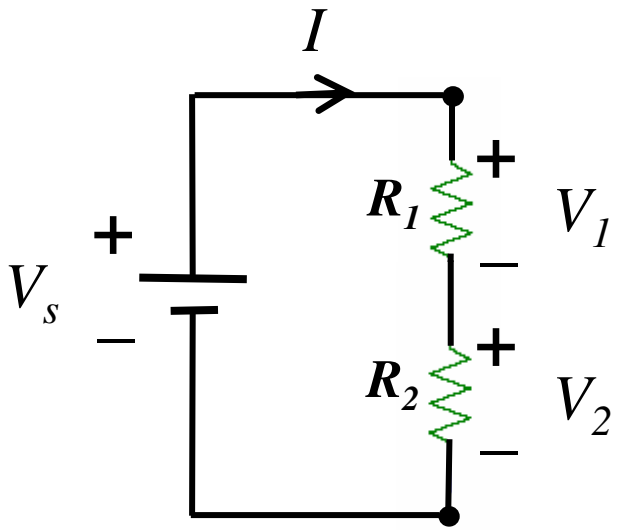
ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

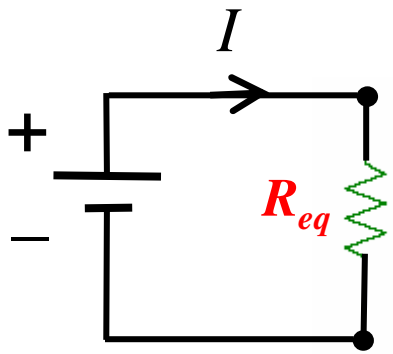
Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\dfrac{di(t)}{dt}$	$i(t) = C\dfrac{dv(t)}{dt}$



- **RESISTÊNCIAS EM SÉRIE:**

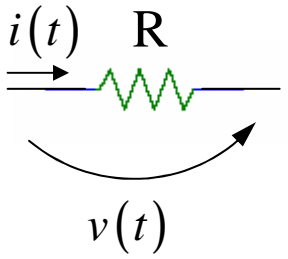
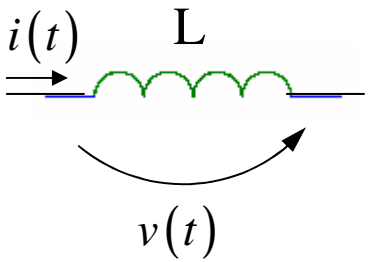
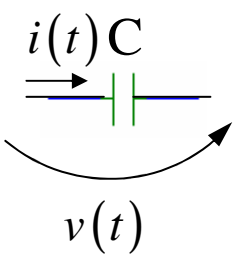
$$-V_s + R_1 I + R_2 I = 0$$

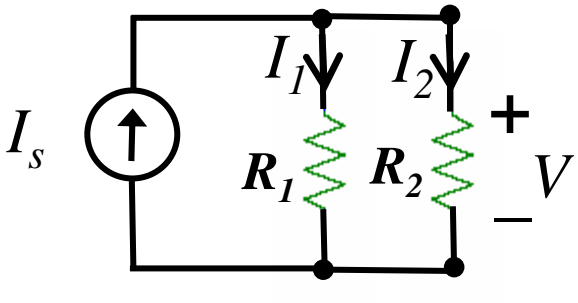
$$V_s = \underbrace{(R_1 + R_2)}_{R_{eq}} I \qquad V_s = R_{eq} I$$



$$R_{eq} = \sum_{k=1}^{N} R_k$$

ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\dfrac{di(t)}{dt}$	$i(t) = C\dfrac{dv(t)}{dt}$



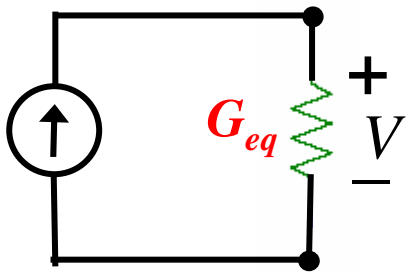
- **RESISTÊNCIAS EM PARALELO** $\left(I = GV, \quad G = \dfrac{1}{R} \right)$:

$$-I_s + I_1 + I_2 = 0$$

$$I_s = G_1 V + G_2 V$$

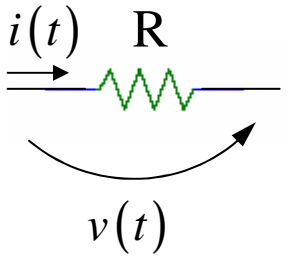
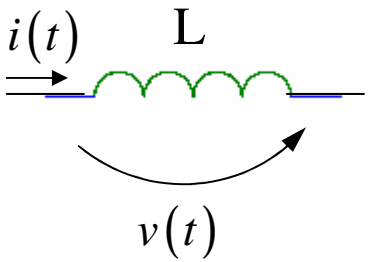
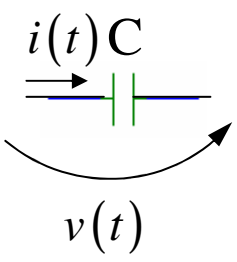
$$I_s = \underbrace{(G_1 + G_2)}_{G_{eq}} V$$

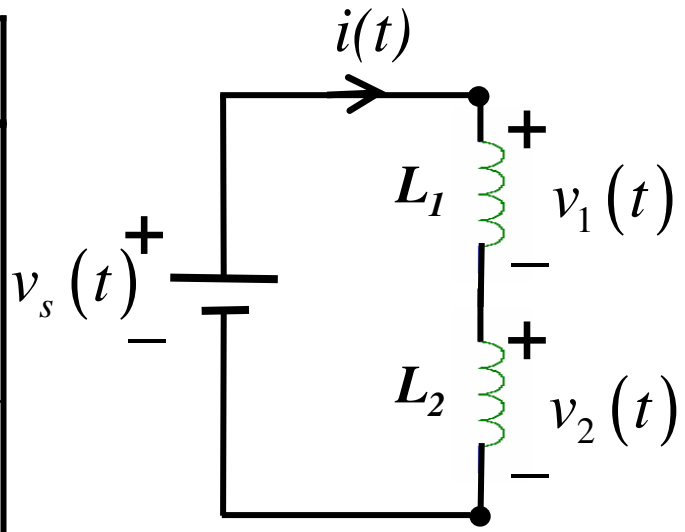
$$I_s = G_{eq} V$$



$$G_{eq} = \sum_{k=1}^{N} G_k$$

ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\dfrac{di(t)}{dt}$	$i(t) = C\dfrac{dv(t)}{dt}$

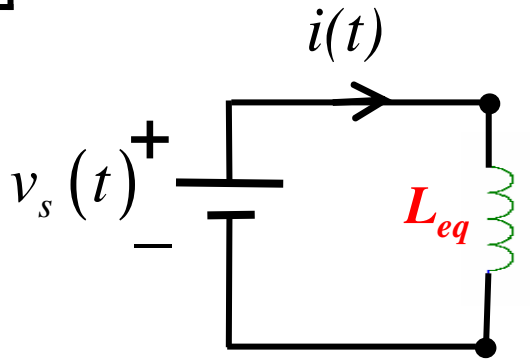


- **BOBINAS EM SÉRIE:**

$$-v_s(t) + v_1(t) + v_2(t) = 0$$

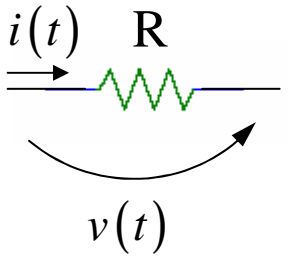
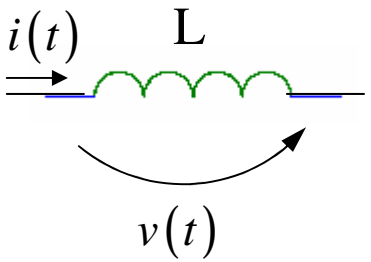
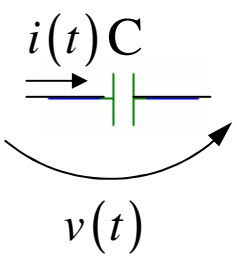
$$v_s(t) = L_1\frac{di(t)}{dt} + L_2\frac{di(t)}{dt}$$

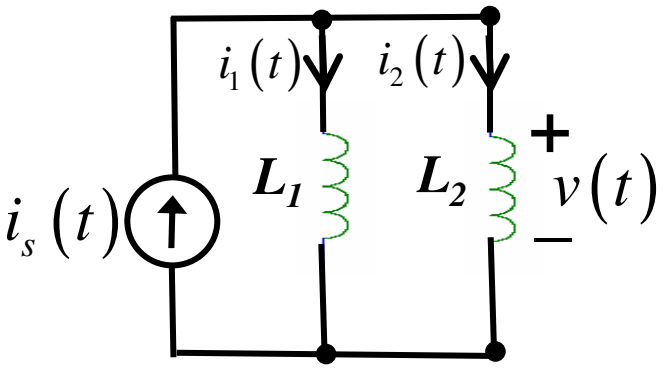
$$v_s(t) = \underbrace{(L_1 + L_2)}_{L_{eq}}\frac{di(t)}{dt} \qquad v_s(t) = L_{eq}\frac{di(t)}{dt}$$



$$L_{eq} = \sum_{k=1}^{N} L_k$$

ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\frac{di(t)}{dt}$	$i(t) = C\frac{dv(t)}{dt}$

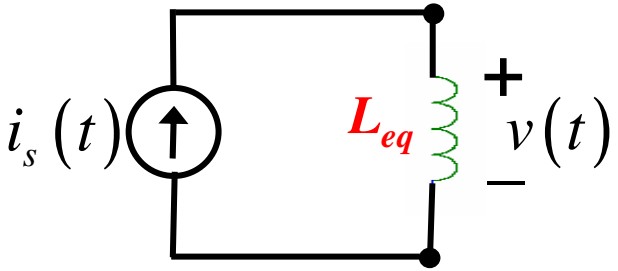


- **BOBINAS EM PARALELO** $\left(i(t) = \frac{1}{L}\int_0^t v(t)dt \right)$:

$$i_s(t) - i_1(t) - i_2(t) = 0$$

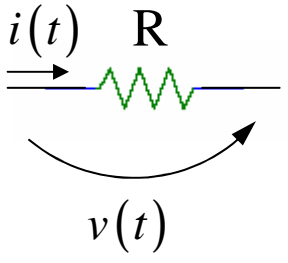
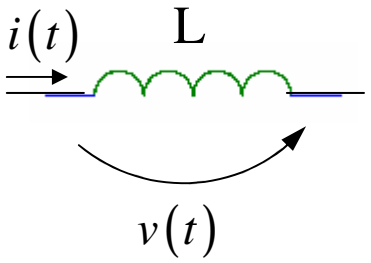
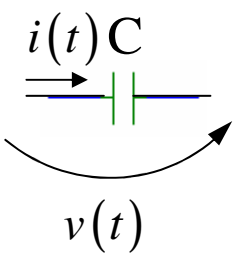
$$i_s(t) = \left(\frac{1}{L_1} + \frac{1}{L_2} \right) \int_0^t v(t)\,dt \qquad i_s(t) = \frac{1}{L_{eq}} \int_0^t v(t)\,dt$$

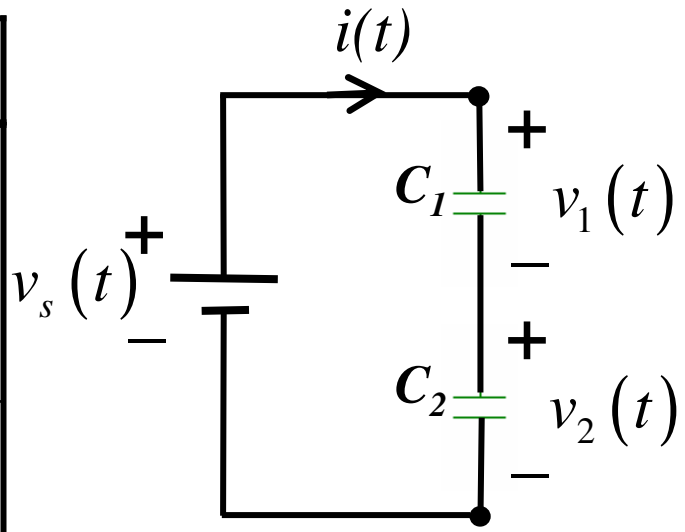
$$1/L_{eq}$$



$$\frac{1}{L_{eq}} = \sum_{k=1}^{N} \frac{1}{L_k}$$

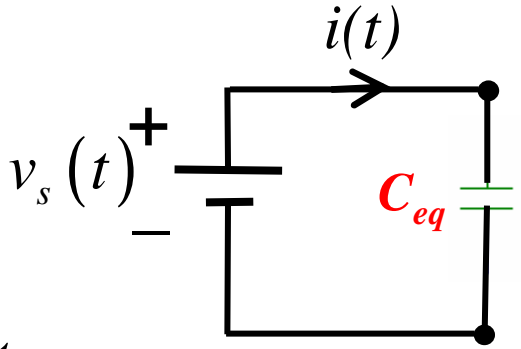
ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\dfrac{di(t)}{dt}$	$i(t) = C\dfrac{dv(t)}{dt}$



- **CONDENSADORES EM SÉRIE** $\left(v(t) = \dfrac{1}{C}\int_0^t i(t)dt \right)$:

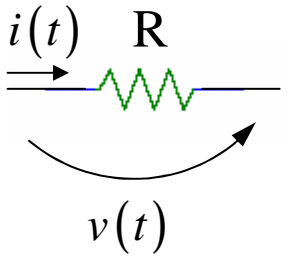
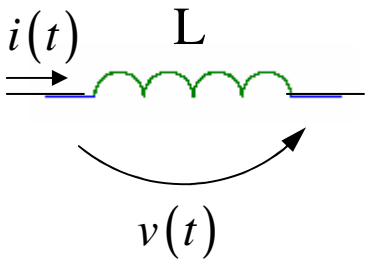
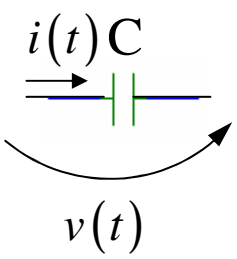
$$-v_s(t) + v_1(t) + v_2(t) = 0$$

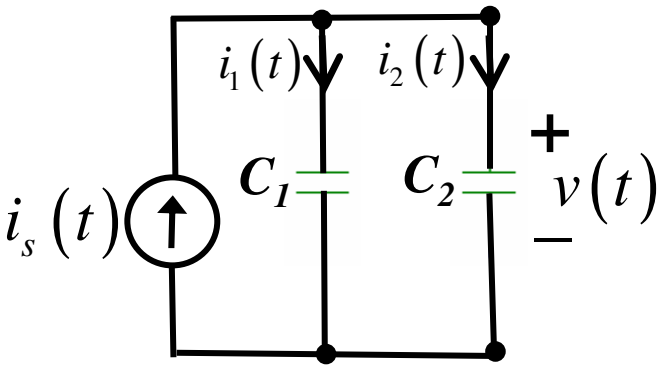


$$v_s(t) = \underbrace{\left(\frac{1}{C_1} + \frac{1}{C_2}\right)}_{1/C_{eq}} \int_0^t i(t)\,dt \qquad v_s(t) = \frac{1}{C_{eq}}\int_0^t i(t)\,dt$$

$$\frac{1}{C_{eq}} = \sum_{k=1}^{N} \frac{1}{C_k}$$

ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

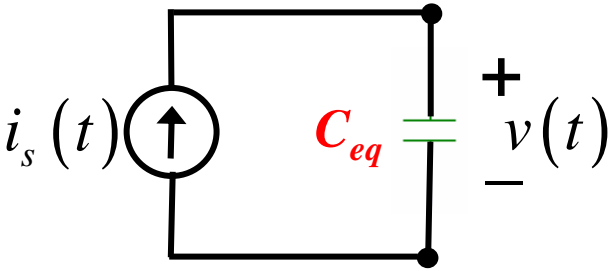
Resistência	Bobina	Condensador
		
$v(t) = Ri(t)$	$v(t) = L\dfrac{di(t)}{dt}$	$i(t) = C\dfrac{dv(t)}{dt}$



- **CONDENSADORES EM PARALELO:**

$$i_s(t) - i_1(t) - i_2(t) = 0$$

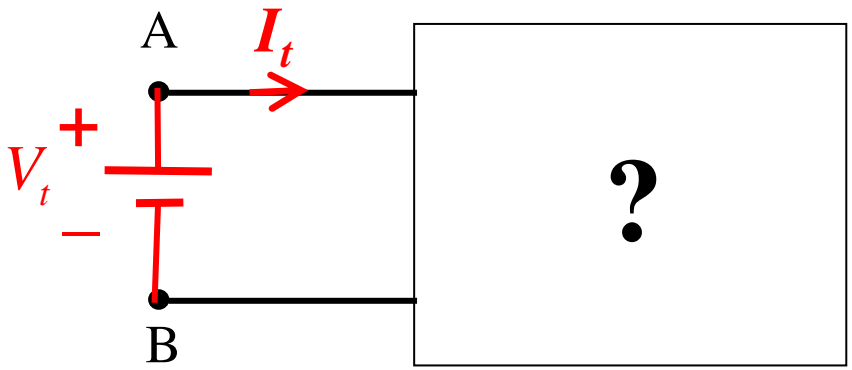
$$i_s(t) = \underbrace{(C_1 + C_2)}_{C_{eq}}\frac{dv(t)}{dt} \qquad i_s(t) = C_{eq}\frac{dv(t)}{dt}$$

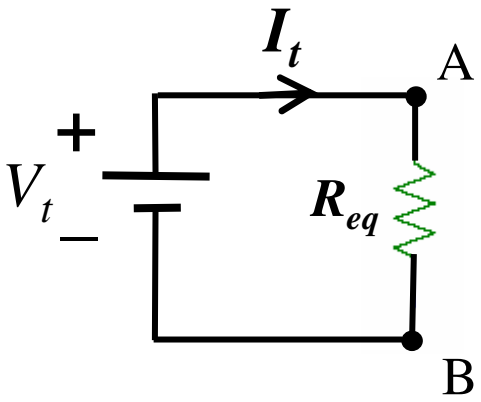


$$C_{eq} = \sum_{k=1}^{N} C_k$$

ASSOCIAÇÃO DE ELEMENTOS PASSIVOS

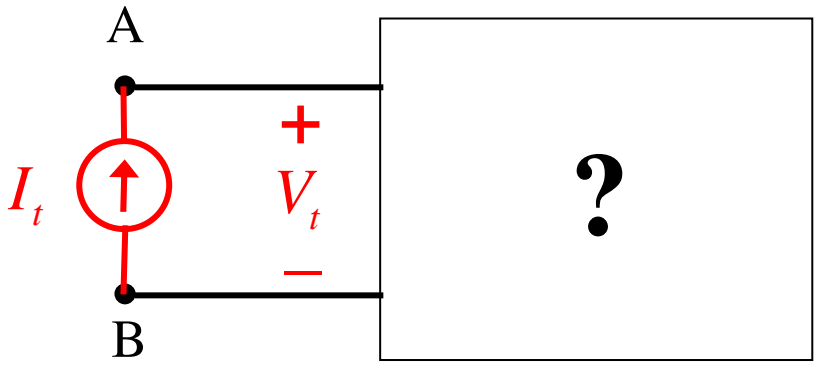
CIRCUITO RESISTIVO DE COMPLEXIDADE ARBITRÁRIA

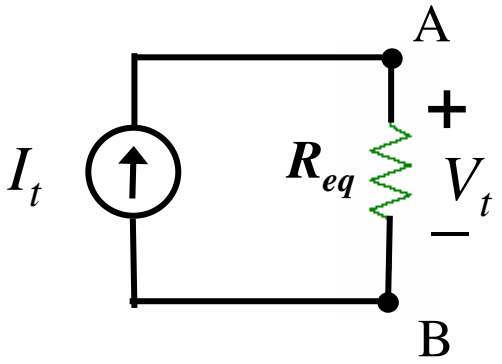




$$R_{eq} = \frac{V_t}{I_t}$$

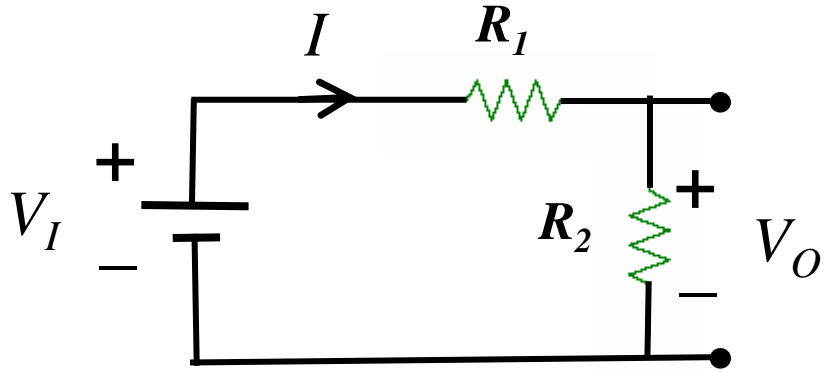
ou, alternativamente:





DIVISOR DE TENSÃO

Qual a tensão de saída V_o quando aos terminais da série se aplica V_I ?



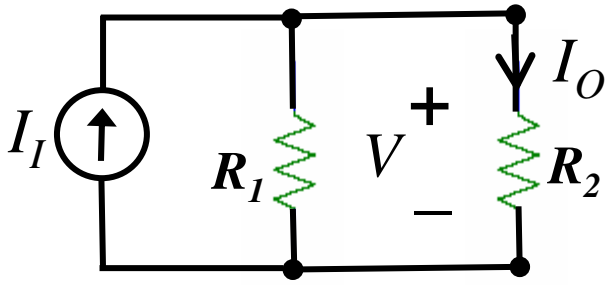
$$-V_I + R_1 I + R_2 I = 0$$

$$V_I = (R_1 + R_2) I \qquad \text{mas:} \quad I = \frac{V_O}{R_2}$$

$$V_O = \frac{R_2}{R_1 + R_2} V_I$$

DIVISOR DE CORRENTE

Qual a corrente de saída I_o quando entra no nó a corrente I_I ?



$$I_I = \frac{V}{R_1} + \frac{V}{R_2} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right) V \qquad \text{mas:} \quad V = R_2 I_O$$

$$I_O = \frac{R_1}{R_1 + R_2} I_I$$

ELEMENTOS DE CIRCUITO

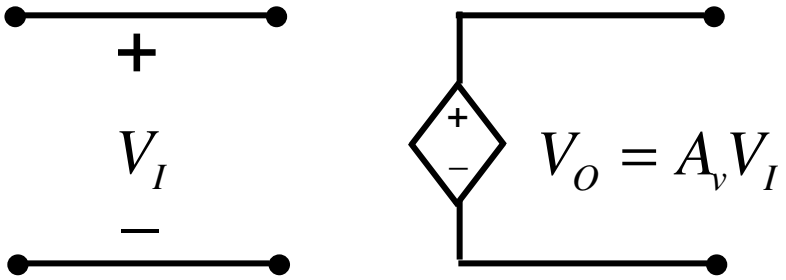
- elementos activos
  - Fontes de tensão
  - Fontes de corrente

✓ Independentes

✓ **Dependentes**

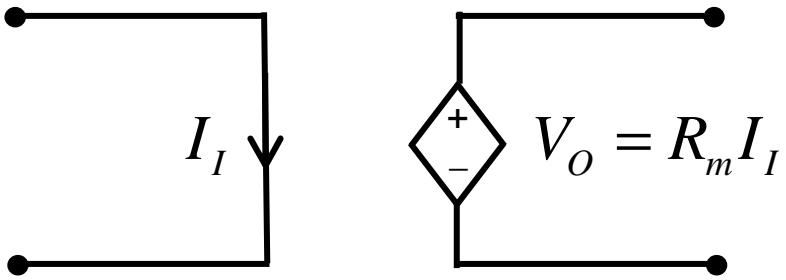
Fontes de:

- **Tensão** controladas por **tensão:**



A_v – ganho de tensão

- **Tensão** controladas por **corrente:**



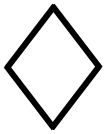
R_m – ganho de trans-impedância

ELEMENTOS DE CIRCUITO

- elementos activos
  - Fontes de tensão
  - Fontes de corrente

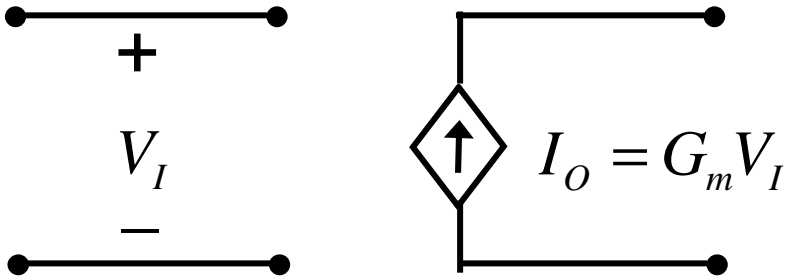
  ✓ Independentes

  ✓ Dependentes



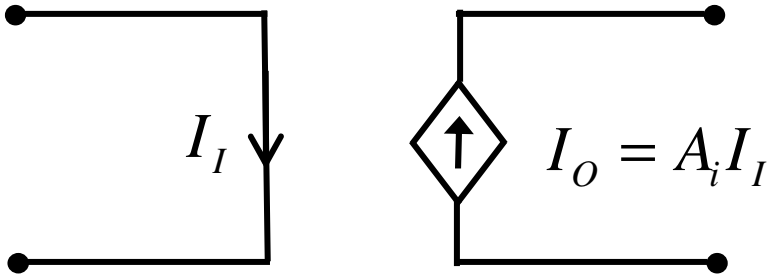
Fontes de:

- **Corrente** controladas por **tensão**



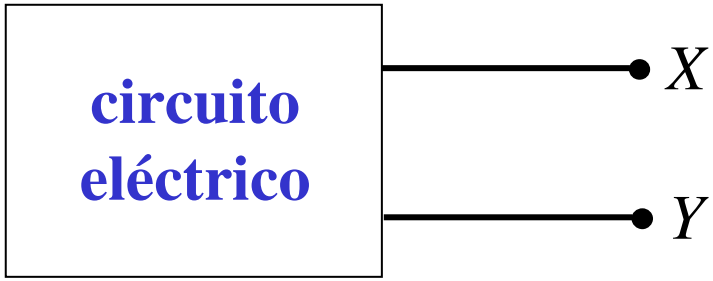
G_m – ganho de trans-condutância

- **Corrente** controladas por **corrente**

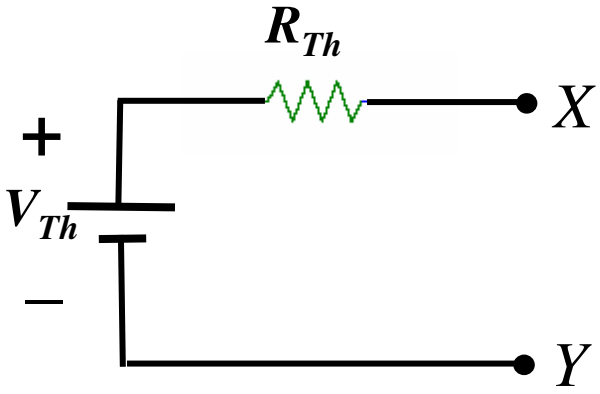


A_i – ganho de corrente

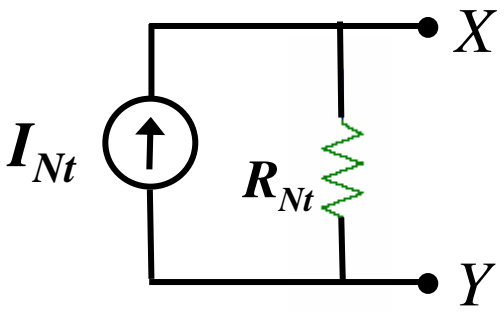
circuito eléctrico formado por resistências e fontes independentes:



TEOREMA DE THÉVENIN:



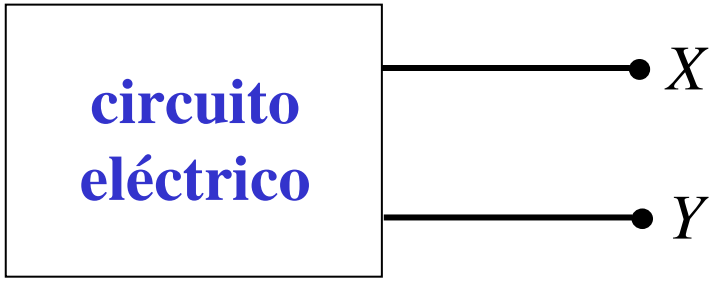
TEOREMA DE NORTON:



$$V_{Th} = R_{Th} I_{Nt}$$

- V_{th} (tensão de Thévenin): tensão em circuito aberto aos terminais *X* e *Y*.
- R_{Th}=R_{Nt} (resistência equivalente): vista a partir dos terminais *X* e *Y* com todas as fontes independentes anuladas.
- I_{Nt} (corrente de Norton): corrente em curto-circuito entre os terminais *X* e *Y*.

circuito eléctrico formado por resistências e fontes independentes:



TEOREMA DA SOBREPOSIÇÃO