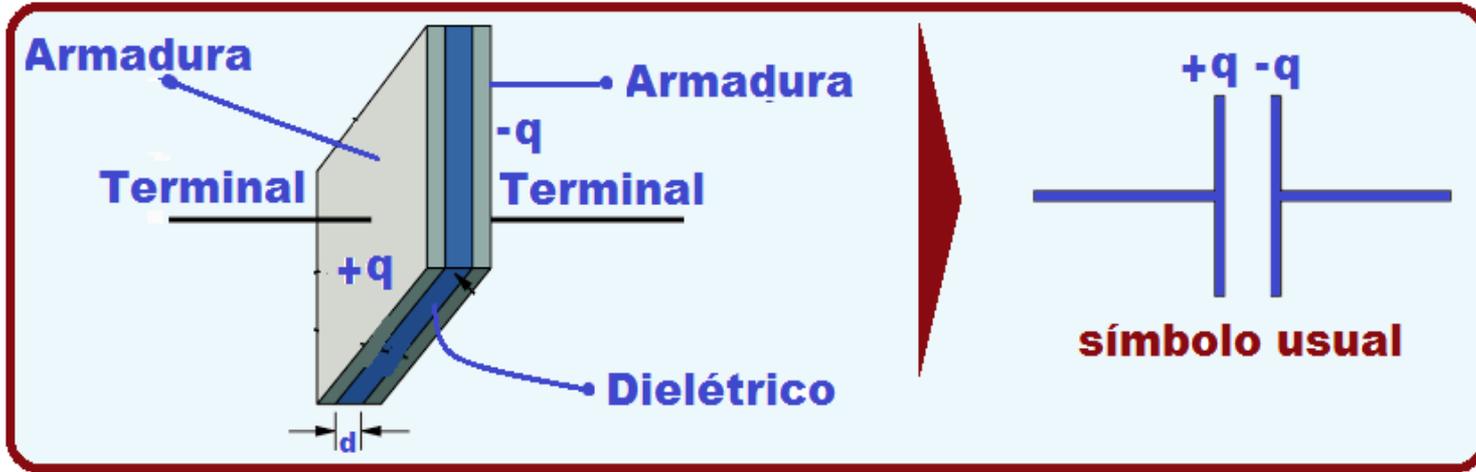


# CAPACITORES E INDUTORES

## CARACTERÍSTICAS E APLICAÇÕES

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abril/2022

# CAPACITORES



$$C = \epsilon \frac{A}{d}$$

Unidade: Farad (F)

Fonte: [fisicavestibulares.com.br](http://fisicavestibulares.com.br)

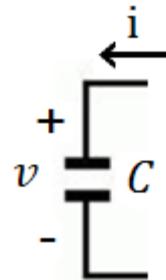
$\epsilon \Rightarrow$  *permissividade Elétrica*

Dielétrico: ar, vácuo, papel impregnado com óleo, cera, isopor, mica, vidro, cerâmica ou Mylar



Fonte: [resumoescolar.com.br](http://resumoescolar.com.br)

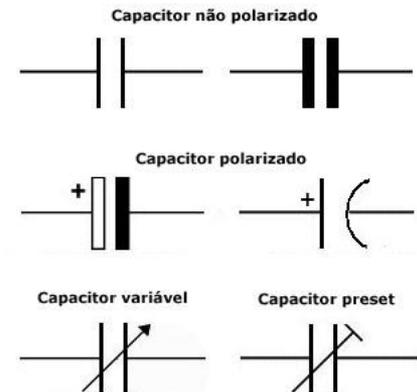
- Princípio Físico: carga é proporcional à tensão aplicada aos terminais.



$$q = C \cdot v$$

$$i = \frac{dq}{dt}$$

$$i = C \frac{dv}{dt}$$



- Formulação Integral:  $dv = \frac{1}{C} i dt$

$$v(t) = \frac{1}{C} \int_{-\infty}^t i(t) dt \quad v(t) = \frac{1}{C} \int i(t) dt + K \quad v(t) = \frac{1}{C} \int_{t_0}^t i(t) dt + v(t_0)$$

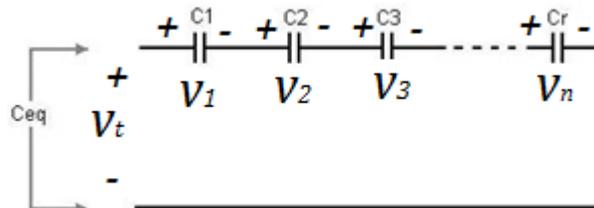
K=> depende das condições de contorno

- Potência:  $p(t) = v(t) \cdot i(t) = C v(t) \cdot \frac{dv(t)}{dt} \quad (W)$

- Energia:  $w(t) = \int_{-\infty}^t p(t) dt = \int_{-\infty}^t C v(t) \cdot \frac{dv(t)}{dt} dt \Rightarrow w(t) = \int_{v(-\infty)}^{v(t)} C \cdot v(t) \cdot dv(t)$

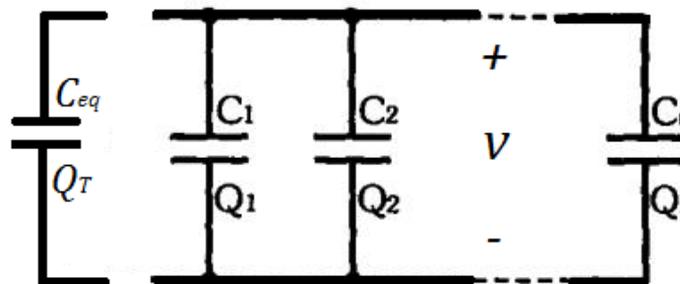
$w(t) = \frac{1}{2} \cdot C \cdot v^2(t) \Big|_{v(-\infty)}^{v(t)} \quad (Joules) \quad \text{Se } v(-\infty) = 0V \quad \text{Então: } w(t) = \frac{1}{2} \cdot C \cdot v^2(t) \quad (J)$

- Associação Série de Capacitores



$$v_t = v_1 + v_2 + \dots + v_n \Rightarrow \frac{q}{C_{eq}} = \frac{q}{C_1} + \frac{q}{C_2} + \dots + \frac{q}{C_n} \Rightarrow \frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_n}$$

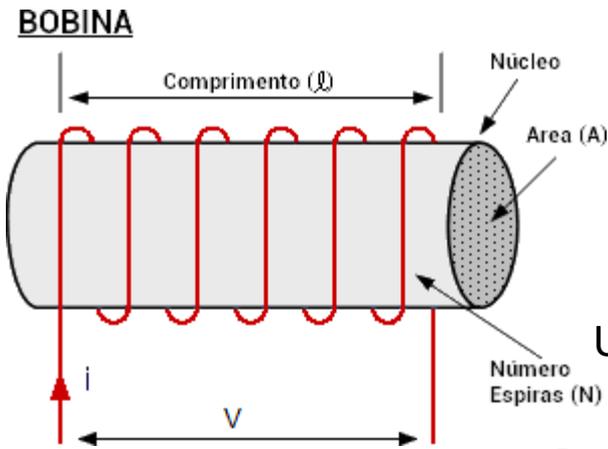
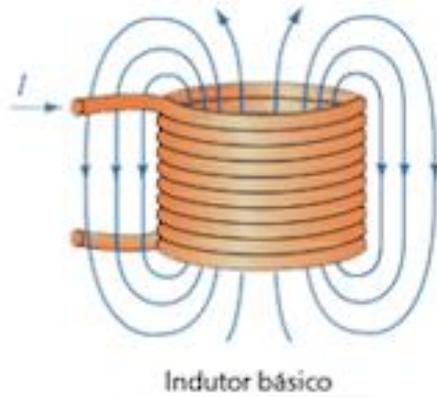
- Associação Paralela de Capacitores



$$Q_t = Q_1 + Q_2 + \dots + Q_n \Rightarrow C_{eq} \cdot v = C_1 \cdot v + C_2 \cdot v + \dots + C_n \cdot v \Rightarrow$$

$$C_{eq} = C_1 + C_2 + \dots + C_n$$

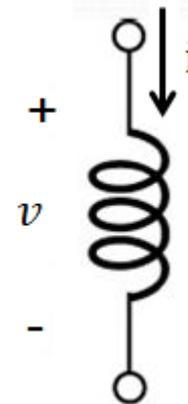
# INDUTORES



$$L = \frac{N^2 \mu A}{l}$$

Unidade: Henry (H)

$\mu \Rightarrow$  Permeabilidade Magnética



$$v = L \frac{di}{dt}$$

- Formulação Integral:  $di = \frac{1}{L} v dt$

$$i(t) = \frac{1}{L} \int_{-\infty}^t v(t) dt \quad i(t) = \frac{1}{L} \int v(t) dt + K \quad i(t) = \frac{1}{L} \int_{t_0}^t v(t) dt + i(t_0)$$

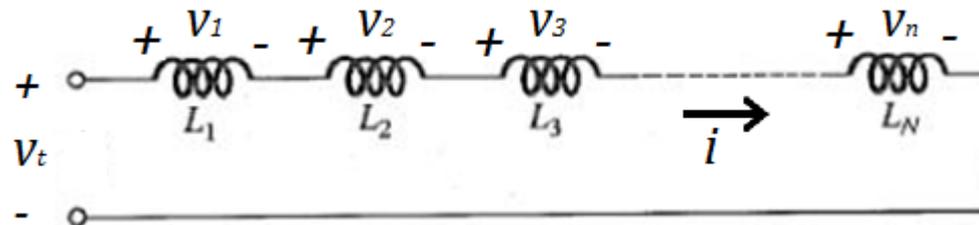
K=> depende das condições de contorno

- Potência:  $p(t) = v(t) \cdot i(t) = Li(t) \cdot \frac{di(t)}{dt} \quad (W)$

- Energia:  $w(t) = \int_{-\infty}^t p(t) dt = \int_{-\infty}^t Li(t) \cdot \frac{di(t)}{dt} dt \Rightarrow w(t) = \int_{i(-\infty)}^{i(t)} L \cdot i(t) \cdot di(t)$

$w(t) = \frac{1}{2} \cdot L \cdot i^2(t) \Big|_{i(-\infty)}^{i(t)} \quad (Joules) \quad \text{Se } i(-\infty) = 0A \quad \text{Então: } w(t) = \frac{1}{2} \cdot L \cdot i^2(t) \quad (J)$

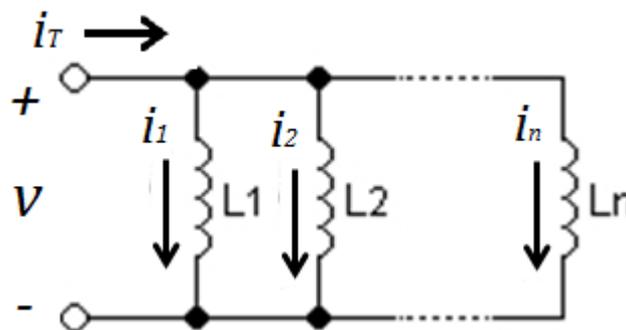
- Associação Série de Indutores



$$v_t = v_1 + v_2 + \dots + v_n \Rightarrow L_{eq} \frac{di}{dt} = L_1 \frac{di}{dt} + L_2 \frac{di}{dt} + \dots + L_n \frac{di}{dt} \Rightarrow$$

$$L_{eq} = L_1 + L_2 + \dots + L_n$$

- Associação Paralela de Indutores

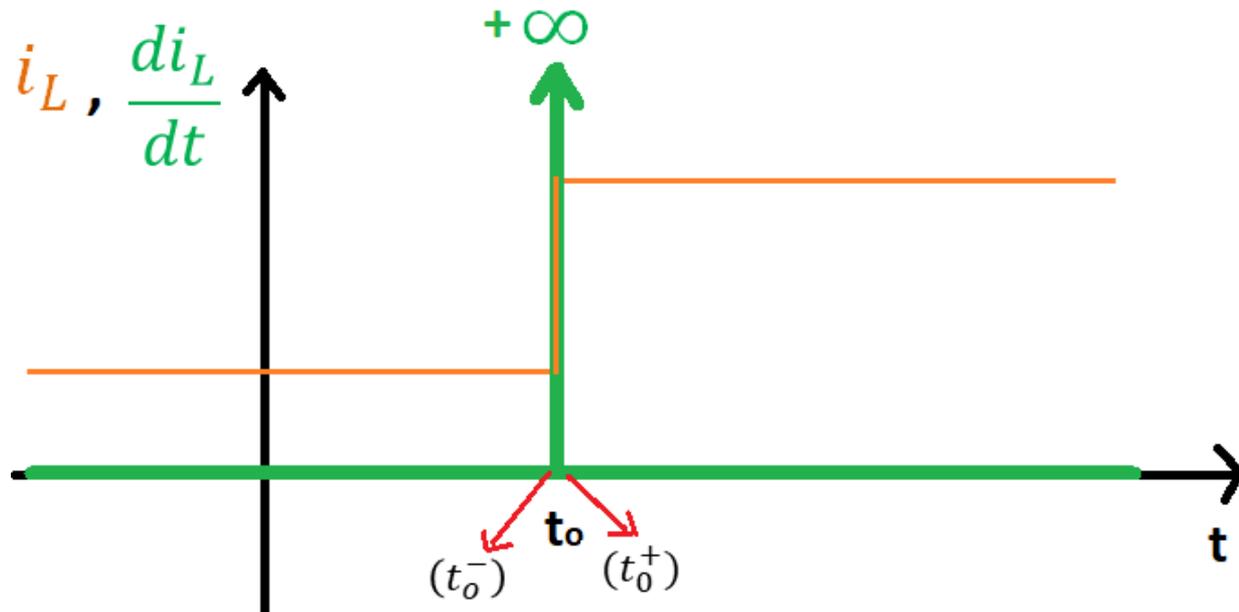


$$i_t = i_1 + i_2 + \dots + i_n \Rightarrow \int \frac{1}{L_{eq}} v dt = \int \frac{1}{L_1} v dt + \int \frac{1}{L_2} v dt + \dots + \int \frac{1}{L_n} v dt \Rightarrow$$

$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \dots + \frac{1}{L_n}$$

❖ Características do INDUTOR:

- Se a corrente for constante (contínua), então:  $v_L = 0V \Rightarrow$  Indutor = curto-circuito
- Variação brusca de corrente causa tensão infinita:  $v_L = L \frac{di_L}{dt}$



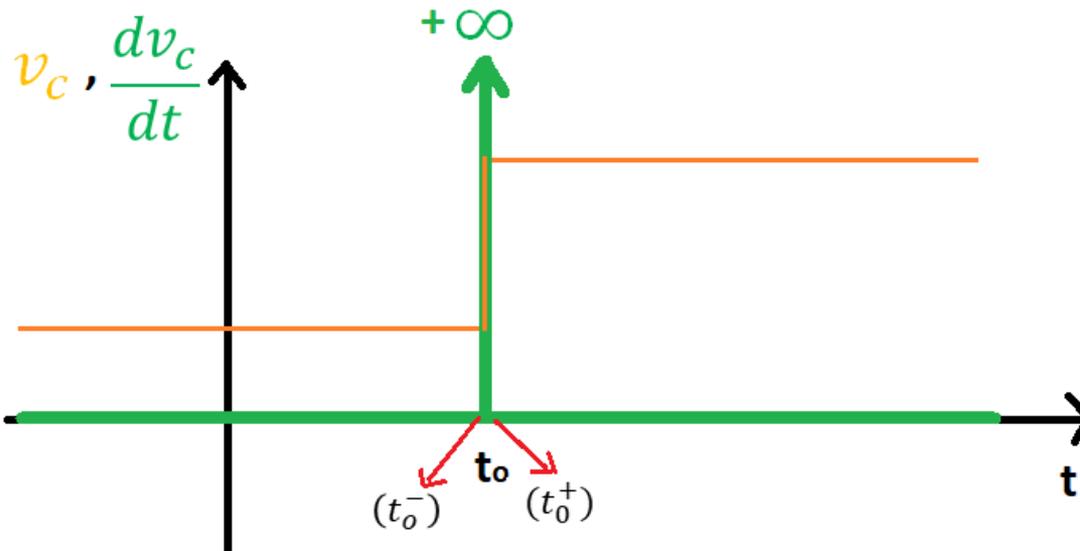
- Em geral, a corrente não varia bruscamente em indutores  $\rightarrow i(t_0^-) = i(t_0^+)$

-Para Indutor ideal a resistência é nula, ou seja, não dissipa energia, só armazena.

❖ Características do CAPACITOR:

- Se a tensão for constante (contínua), então:  $i_C = 0A \Rightarrow$  Capacitor = circuito aberto

- Variação brusca de tensão causa corrente infinita:  $i_C = C \frac{dv_C}{dt}$



- Em geral, a tensão não varia bruscamente em capacitores  $\rightarrow$   $v(t_0^-) = v(t_0^+)$

- Para Capacitor ideal a resistência é nula, ou seja, não dissipa energia, só armazena.

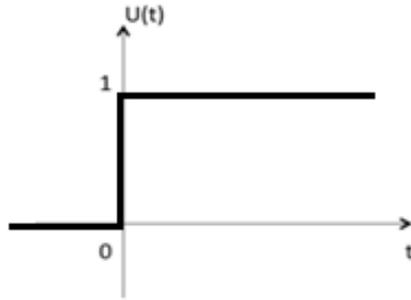
❖ Elemento Passivo: elemento capaz de consumir ou armazenar quantidade finita de energia;

❖ Elemento Ativo: elemento capaz de fornecer quantidade infinita de energia;

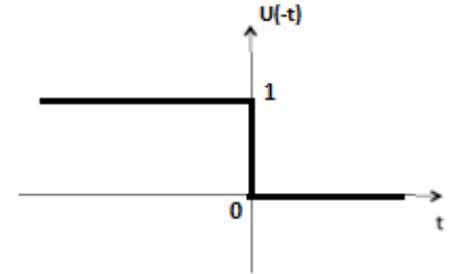


# Função Degrau Unitário – $u(t)$

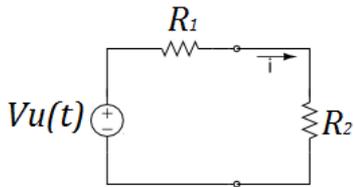
$$u(t) = \begin{cases} 0 & \text{se } t < 0 \\ 1 & \text{se } t > 0 \end{cases}$$



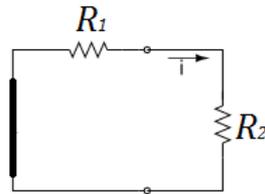
$$u(-t) = \begin{cases} 1 & \text{se } t < 0 \\ 0 & \text{se } t > 0 \end{cases}$$



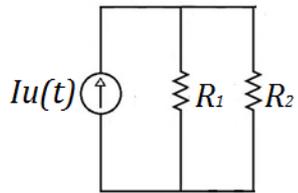
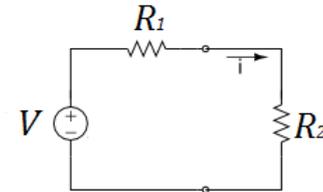
- Aplicação à Fontes:



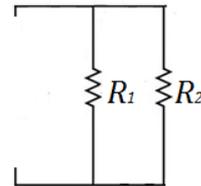
$t < 0s$



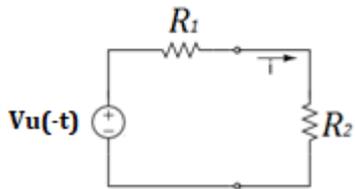
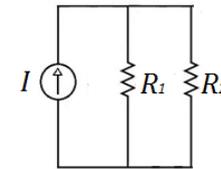
$t > 0s$



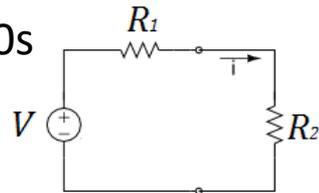
$t < 0s$



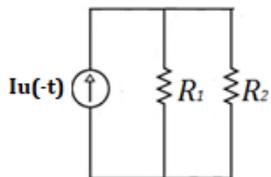
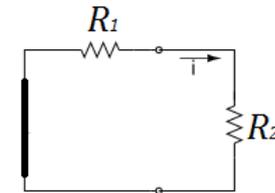
$t > 0s$



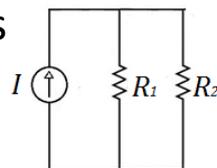
$t < 0s$



$t > 0s$



$t < 0s$



$t > 0s$

