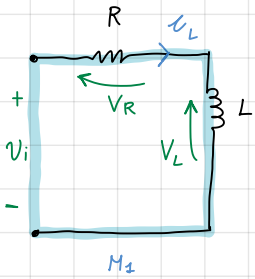


Ciruito Ohmico Induttivo

(VENTILATORE)



$$V_R = R \cdot i_L$$

$$V_L = L \cdot \frac{di_L}{dt}$$

$$LKT_{M1}: V_i - V_L - V_R = 0$$

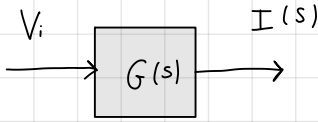
\mathcal{L}
 \Rightarrow

$$V_R = R I(s) \quad (2)$$

$$V_L = sL I(s) \quad (2)$$

$$V_i(s) - V_L(s) - V_R(s) = 0 \quad (3)$$

OBIETTIVO



$$I(s) = \frac{1}{sL} \cdot V_L(s) = \frac{1}{sL} (V_i(s) - V_R(s)) = \frac{1}{sL} (V_i(s) - RI(s))$$

$$= I(s) + \frac{R}{sL} I(s) = \frac{1}{sL} V_i(s)$$

$$\Rightarrow \frac{I(s)}{V_i(s)} = \frac{\frac{1}{sL}}{1 + \frac{R}{sL}} = \boxed{\frac{1}{sL + R}} \quad G(s)$$

$$\Rightarrow G(s) = \frac{1}{R} \cdot \frac{1}{s \left(\frac{L}{R} \right) + 1}$$

Evidenzia
la forma

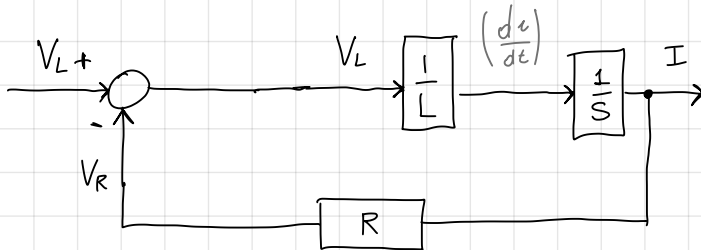
$$\frac{1}{sT + 1}$$

↑
costante
di tempo

FOTO 1

La funzione di trasferimento in questione **ha una dimensione!**

SCHEMA A BLOCCHI



$$\frac{I(s)}{V_i(s)} = \frac{\frac{1}{sL}}{1 + R \cdot \frac{1}{sL}} = \frac{1}{sL + R}$$

SPAZIO DI STATO

$$u = v_i \quad y = i \quad x = i$$

$$\begin{cases} \dot{x} = \frac{1}{L} (u - R \cdot x) \\ y = x \end{cases}$$

$$\begin{cases} \dot{x} = -\left(\frac{R}{L}\right)x + \frac{1}{L}u \\ y = x \end{cases}$$

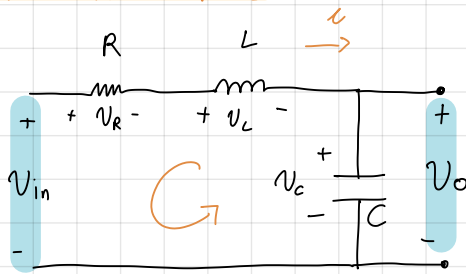
← Reciproco della costante di T

$$\sim \begin{cases} \dot{x} = \underline{A}x + \underline{B}u \\ y = \underline{C}x + \underline{D}u \end{cases}$$

1x1

\sim

CIRCUITO RLC



$$\begin{cases} V_R = R i \\ V_L = L \frac{di}{dt} \\ V_C = C \frac{dV_o}{dt} \\ V_i - V_o - V_L - V_R = 0 \rightarrow V_o = V_i - V_L - V_R \end{cases}$$

$$\dot{x}_1 = i \quad \dot{x}_2 = V_o$$

↑ Var Stato ↑

$$u = V_i \quad y = V_o$$

IN OUT

$$\dot{x}_1 = \frac{1}{L} (u - V_o - R x_1)$$

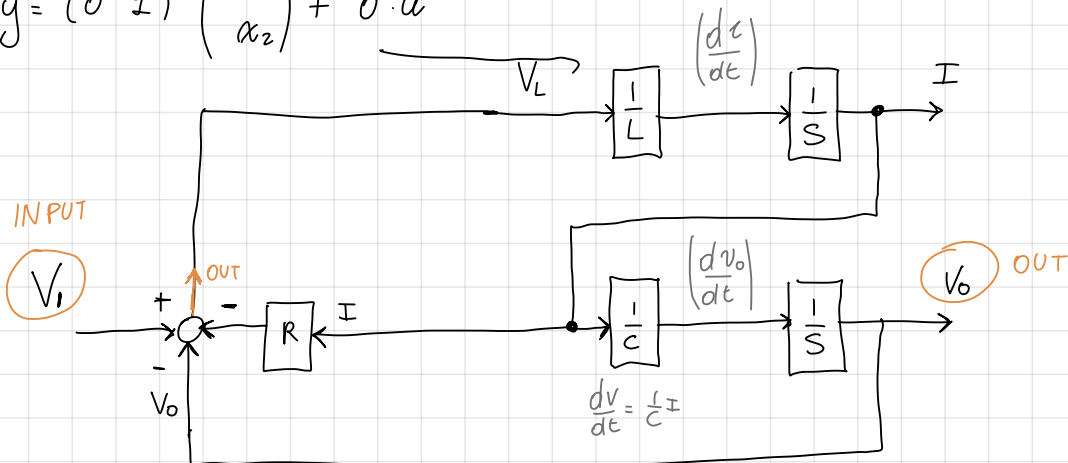
$$\dot{x}_2 = \frac{1}{C} x_1$$

$$y = x_2$$

$$\begin{cases} \dot{x}_1 = -\frac{R}{L} x_1 - \frac{1}{L} x_2 + \frac{1}{L} u \\ \dot{x}_2 = \frac{1}{C} x_1 \\ y = x_2 \end{cases}$$

$$\begin{cases} \dot{x} = \begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \underbrace{\begin{pmatrix} -\frac{R}{L} & \frac{1}{L} \\ \frac{1}{C} & 0 \end{pmatrix}}_{\underline{A}} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \underbrace{\begin{pmatrix} \frac{1}{L} \\ 0 \end{pmatrix}}_{\underline{B}} u \\ y = \begin{pmatrix} 0 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + 0 \cdot u \end{cases}$$

X2 punto è influenzata da u, ma non direttamente!



Troviamo $G(s)$ tra V_i e V_o

$$(1) \quad V_o = \frac{1}{sC} \cdot \oplus = \frac{1}{sC} \cdot \left(\frac{1}{sL} V_L \right) = \frac{1}{sC} \cdot \left[\frac{1}{sL} (-R i - V_o + V_i) \right]$$

$$\rightarrow \text{Solve for } i \rightarrow i = -\frac{R}{sL} i - \frac{1}{sL} V_o + \frac{1}{sL} V_i \rightarrow \left(1 + \frac{R}{sL} \right) i = \frac{1}{sL} (V_i - V_o)$$

$$\Rightarrow i = \frac{1}{R + sL} (V_i - V_o) \quad (2)$$

-> Sub ± in (1) -> $V_o = \frac{1}{sC} \cdot \frac{1}{R+sL} \cdot (V_i - V_o)$

-> Solve for V_o -> $V_o = \frac{1}{s^2 LC + RCs + 1} V_i$

-> Siccome $G(s)$ Tra $V_i(IN)$ e $V_o(OUT)$

$$\frac{V_o}{V_i} = G(s) = \frac{1}{s^2 LC + RCs + 1}$$

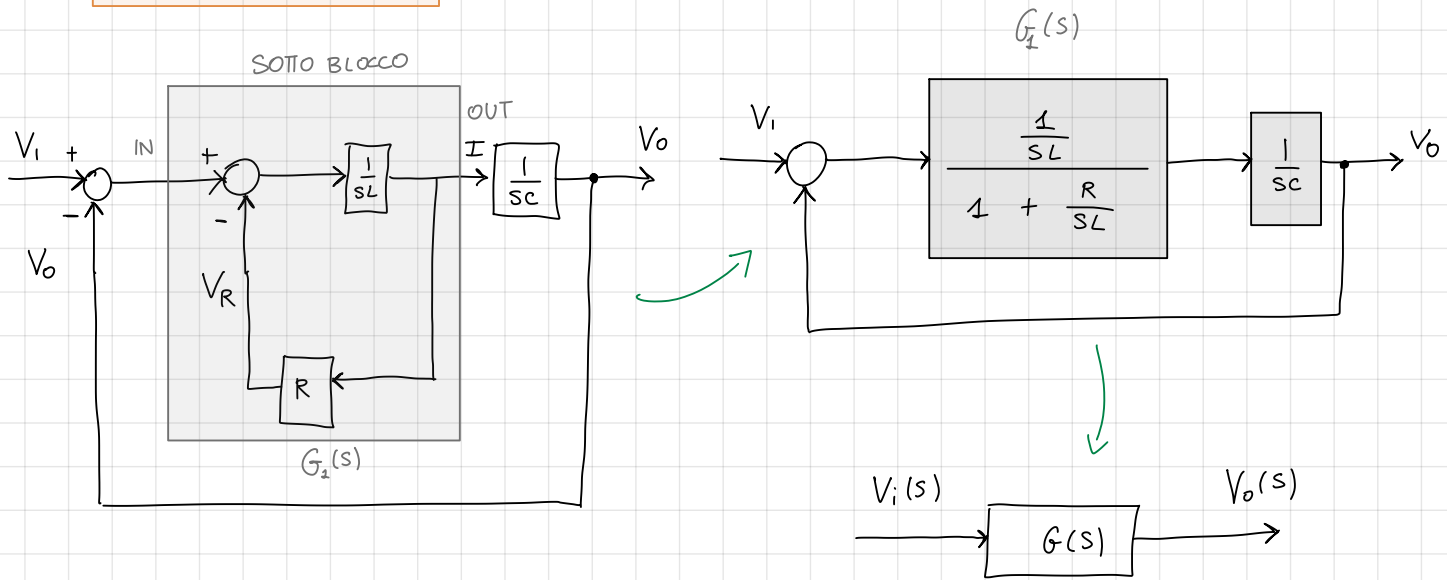
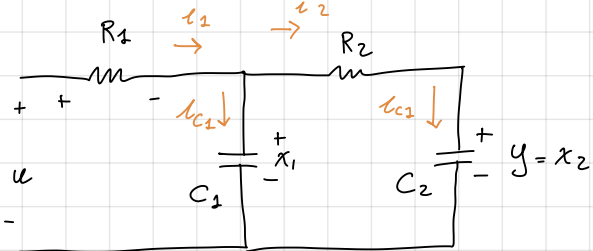
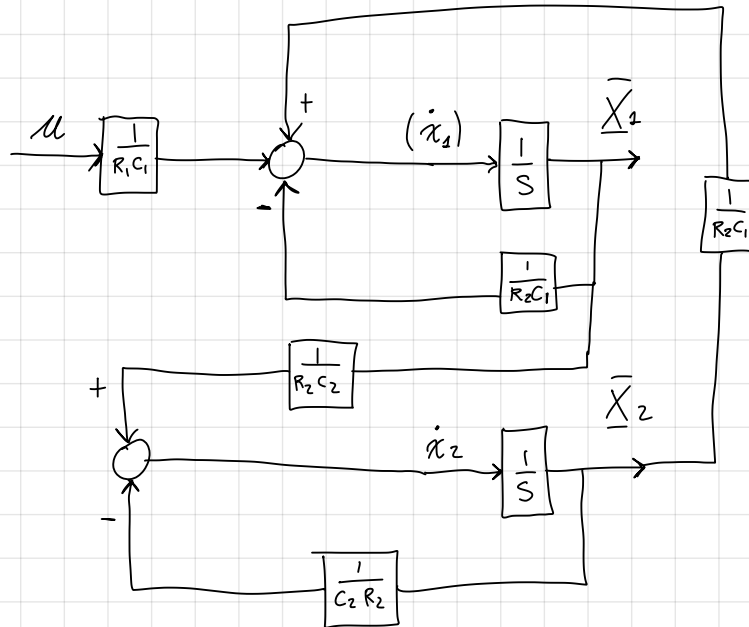


FOTO 2



$$\begin{cases} C_1 \dot{x}_1 = \frac{u - x_1}{R_1} - \frac{1}{R_2} (x_1 - x_2) \\ C_2 \dot{x}_2 = \frac{1}{R_2} (x_1 - x_2) \end{cases} \Rightarrow$$

$$\begin{cases} \dot{x}_1 = -\frac{1}{C_1} \left(\frac{1}{R_1} + \frac{1}{R_2} \right) x_1 + \frac{1}{R_2 C_1} x_2 + \frac{1}{C_1 R_1} u \\ \dot{x}_2 = \frac{1}{R_2 C_2} x_1 - \frac{1}{C_2 R_2} x_2 \\ y = x_2 \end{cases}$$



Funzione di Trasf $x_2(OUT)$ e $u(IN)$

FOTO