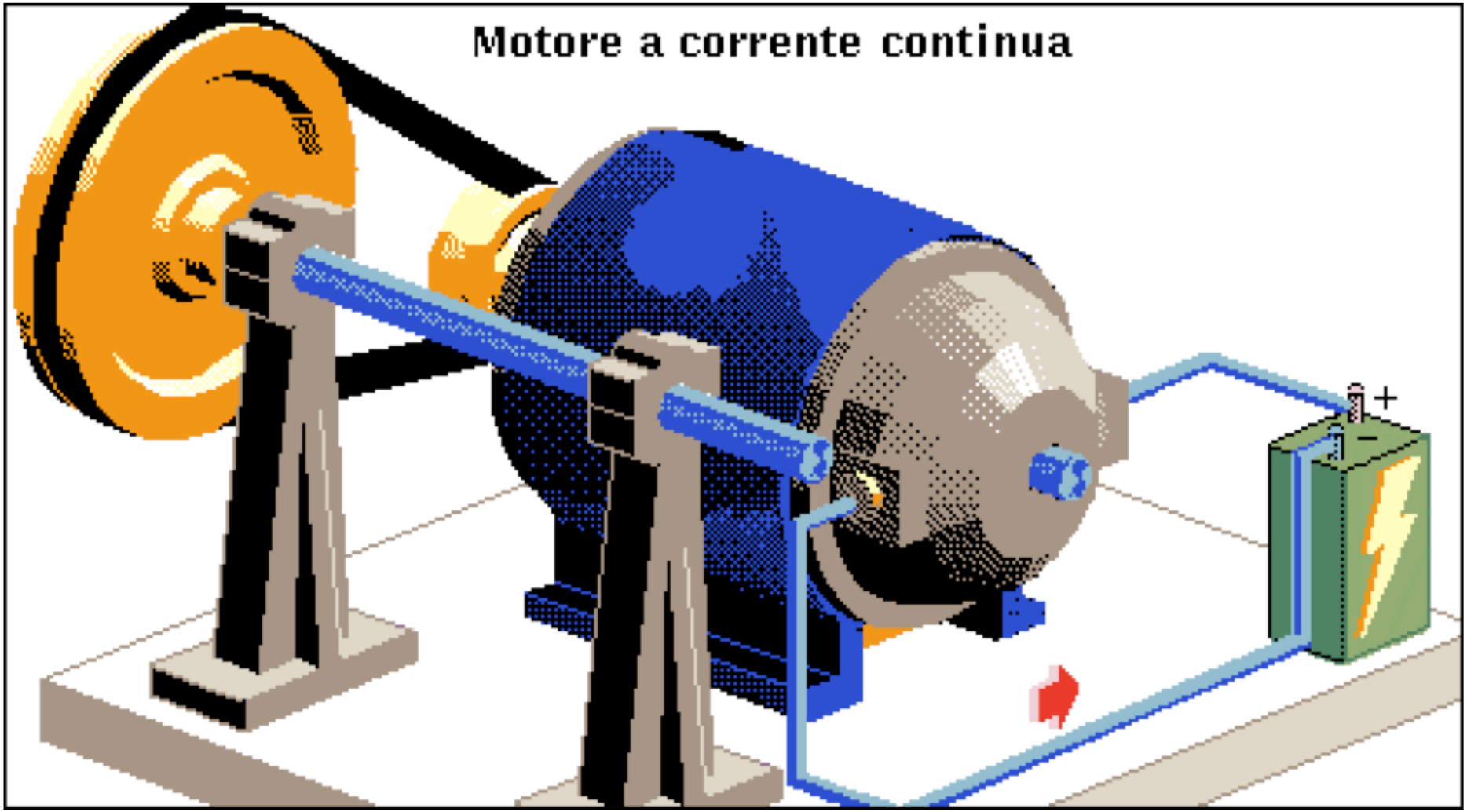
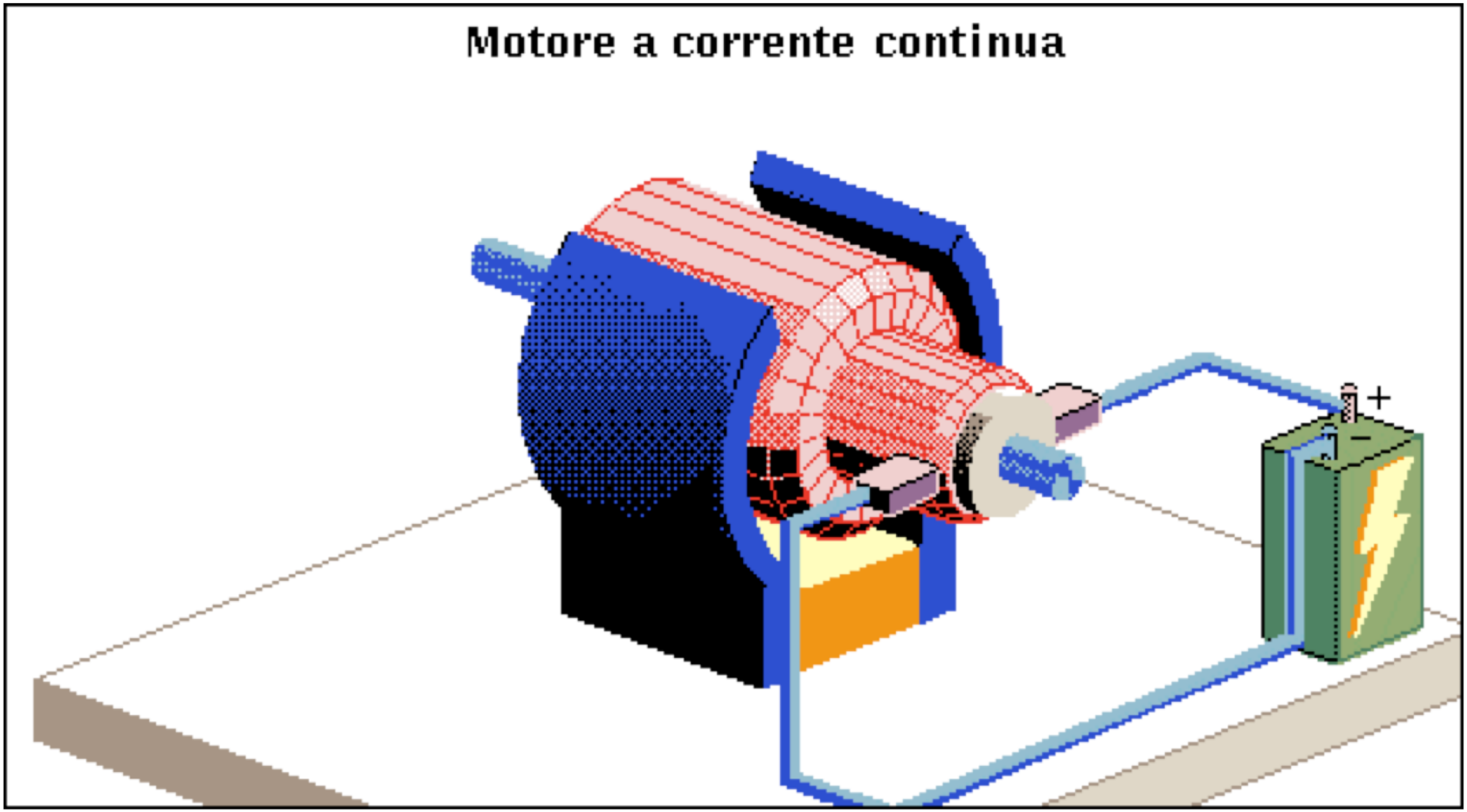
Motore in Corrente Continua

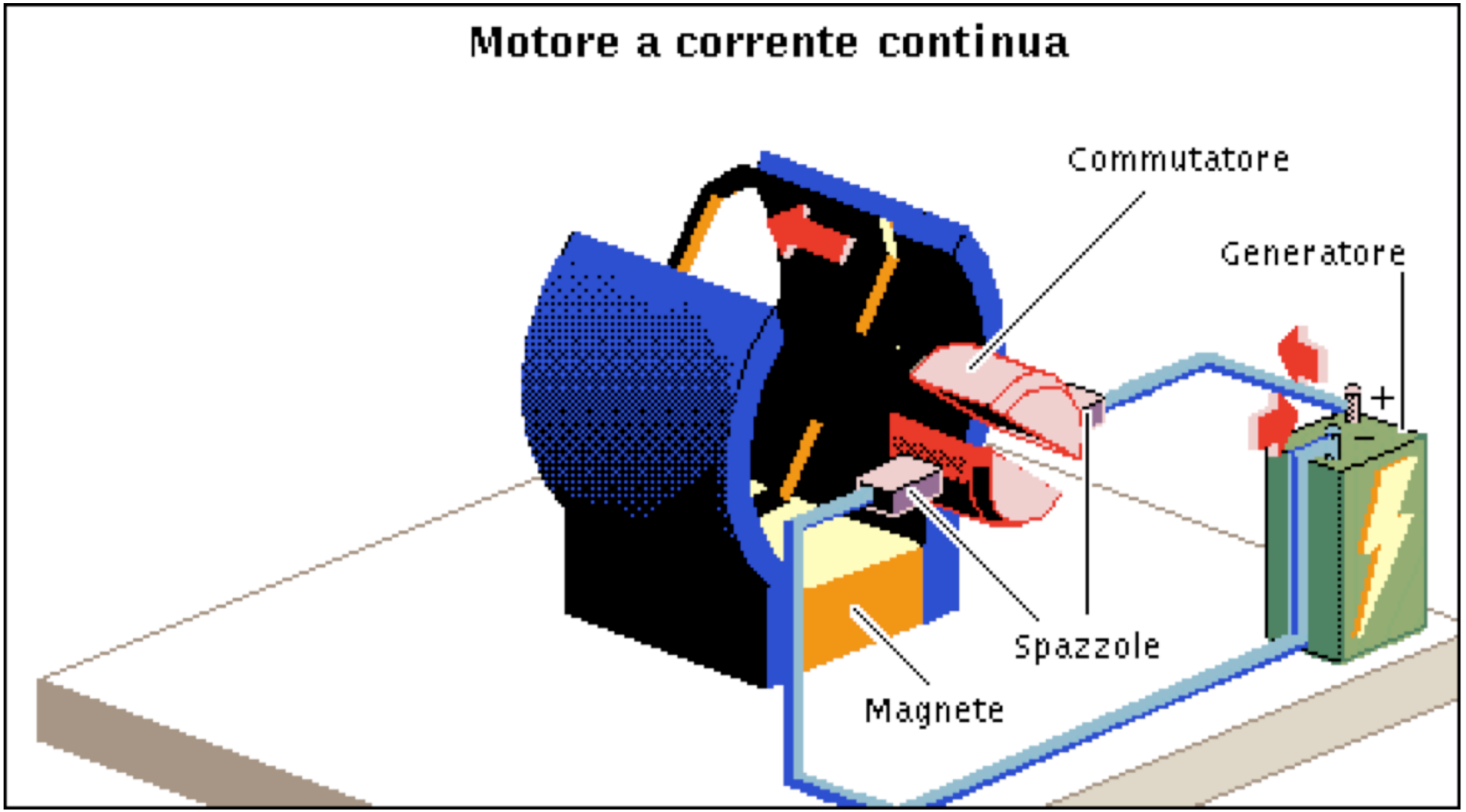
motore, alimentatore e carico



statore e rotore (circuito di armatura)

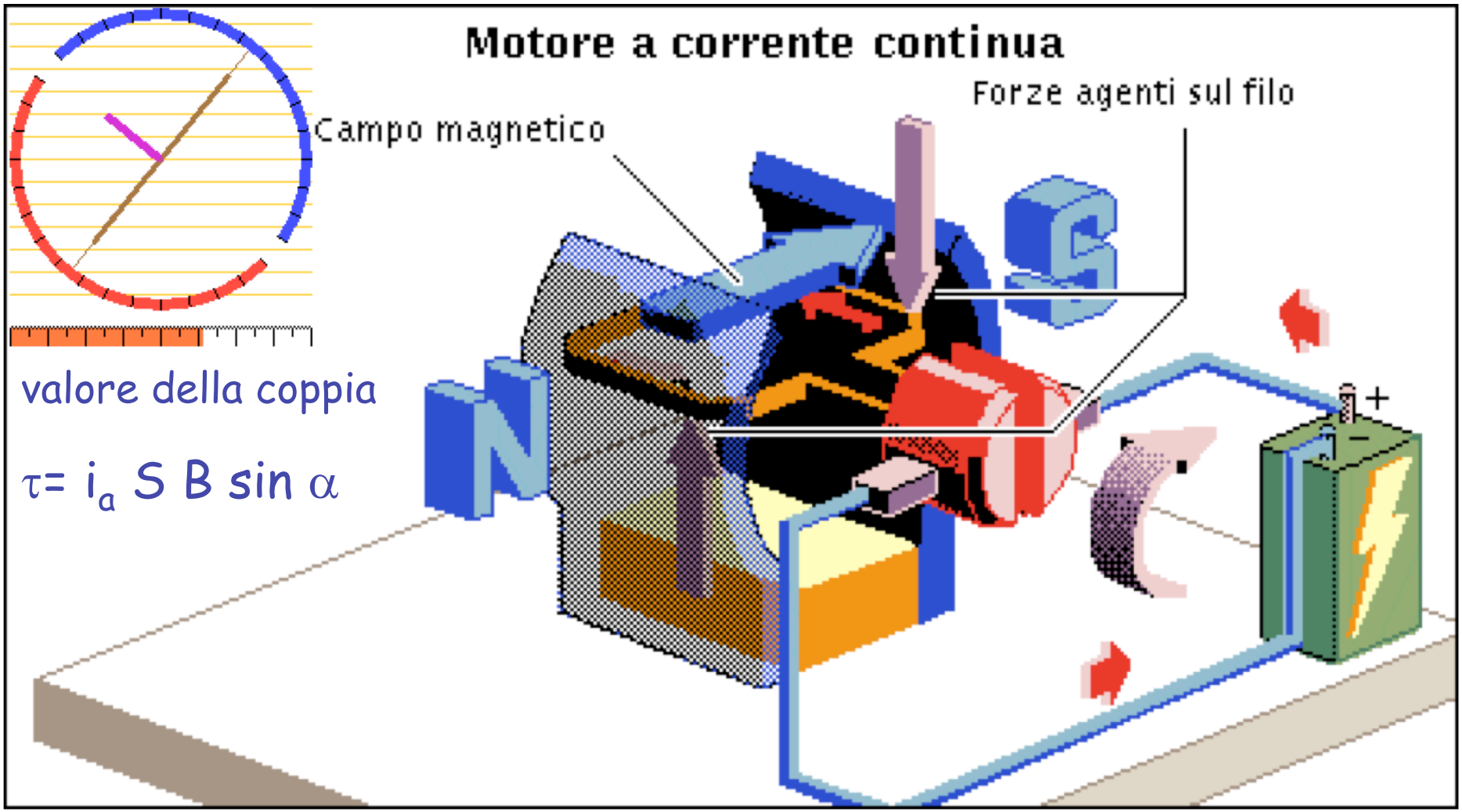


una spira dell'avvolgimento rotorico



- quando la corrente elettrica attraversa una spira immersa in un campo magnetico la forza magnetica produce una coppia che muove il rotore
- la corrente elettrica viene fornita attraverso il commutatore
- la forza magnetica agisce perpendicolarmente alla spira ed al campo magnetico
- il campo magnetico può essere generato da magneti permanenti (campo costante)

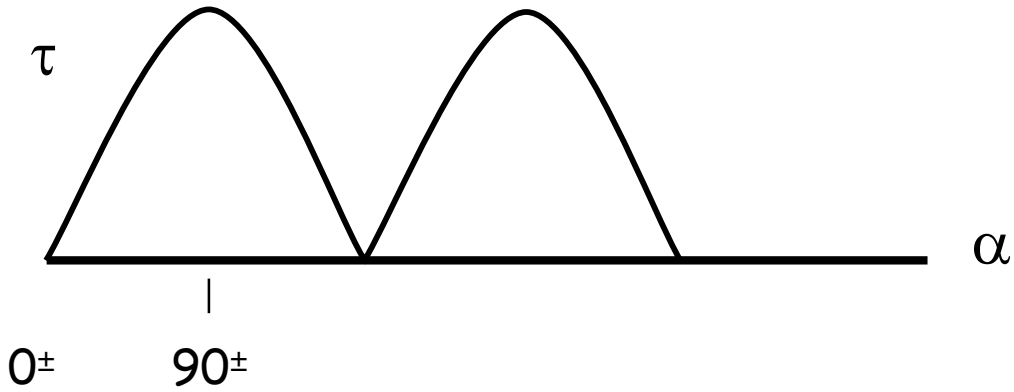
coppia indotta (una sola spira)



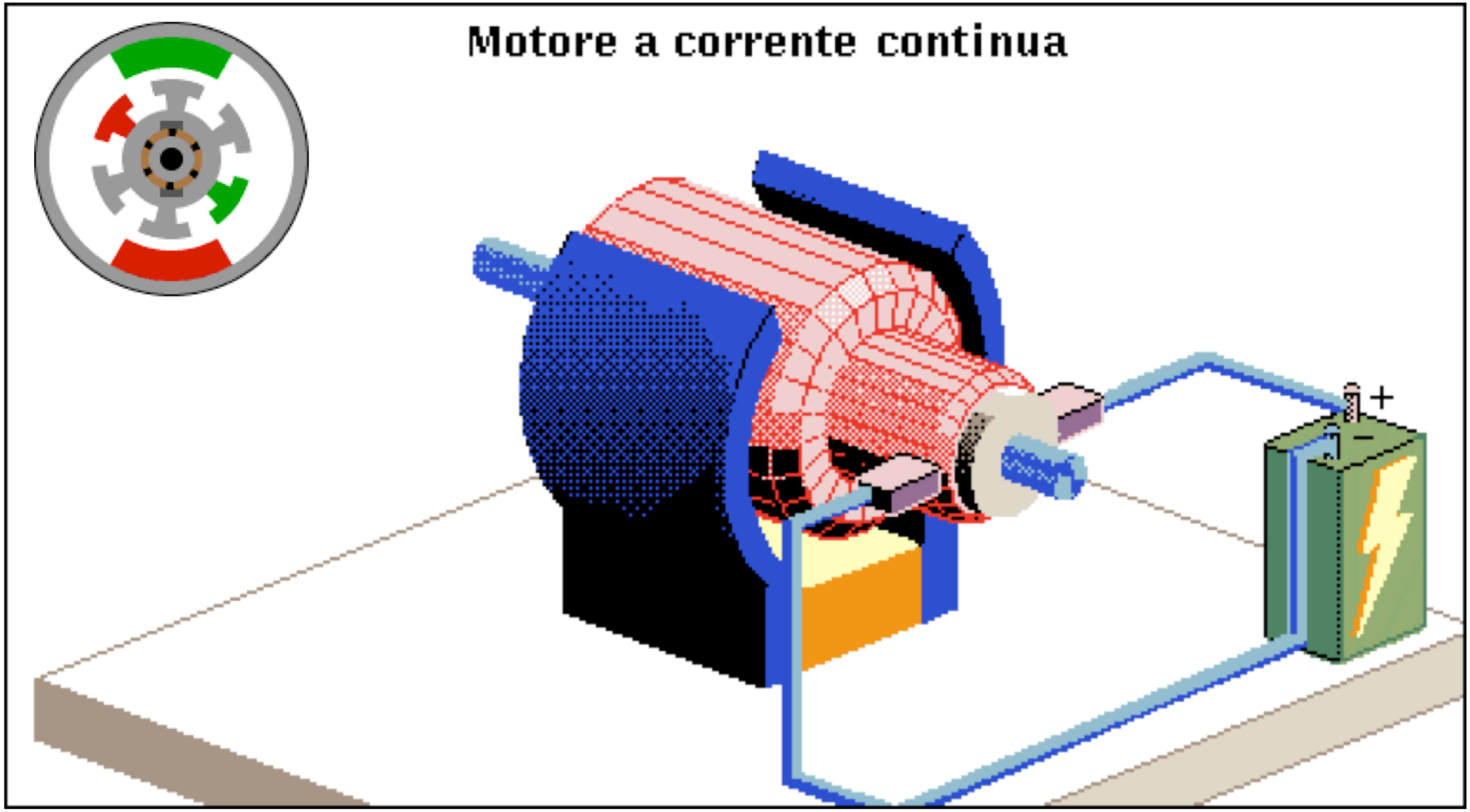
valore della coppia

$\tau = i_a S B \sin \alpha$

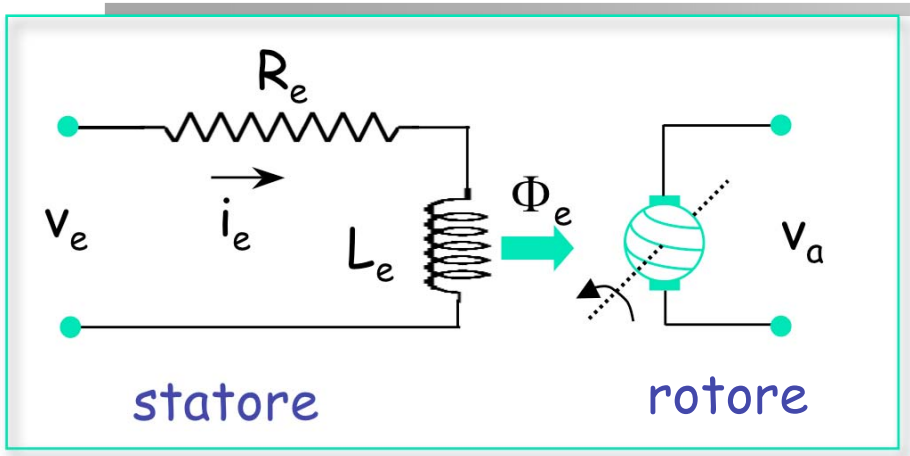
- il commutatore inverte la corrente ad ogni mezzo giro per mantenere costante il verso di rotazione

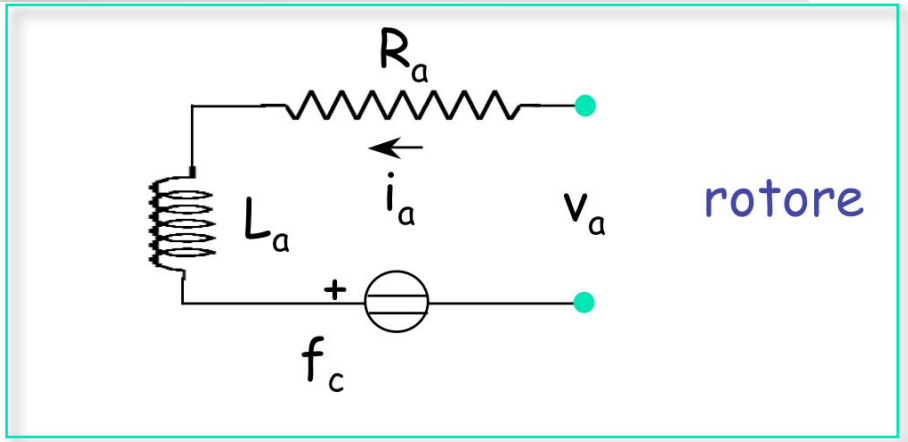


motore con più spire



modello





$$\begin{cases} \Phi_e = k_e i_e \\ f_c = \Phi_e k_c \omega \\ \tau_m = \Phi_e k_a i_a \end{cases}$$

flusso magnetico generato dallo statore

forza controelettromotrice dovuta alla rotazione

momento meccanico o coppia elettromagnetica

$$\begin{cases} v_e = R_e i_e + L_e \frac{di_e}{dt} \\ v_a = R_a i_a + L_a \frac{di_a}{dt} + f_c \end{cases}$$

se si impiegano magneti permanenti o i_e costante
$\rightarrow \Phi_e$ è costante $\rightarrow K_e = k_e\, i_e\, k_c$, $K_t = k_e\, i_e\, k_\alpha \rightarrow f_c = K_e\, \omega$, $\tau_m = K_t\, i_a$

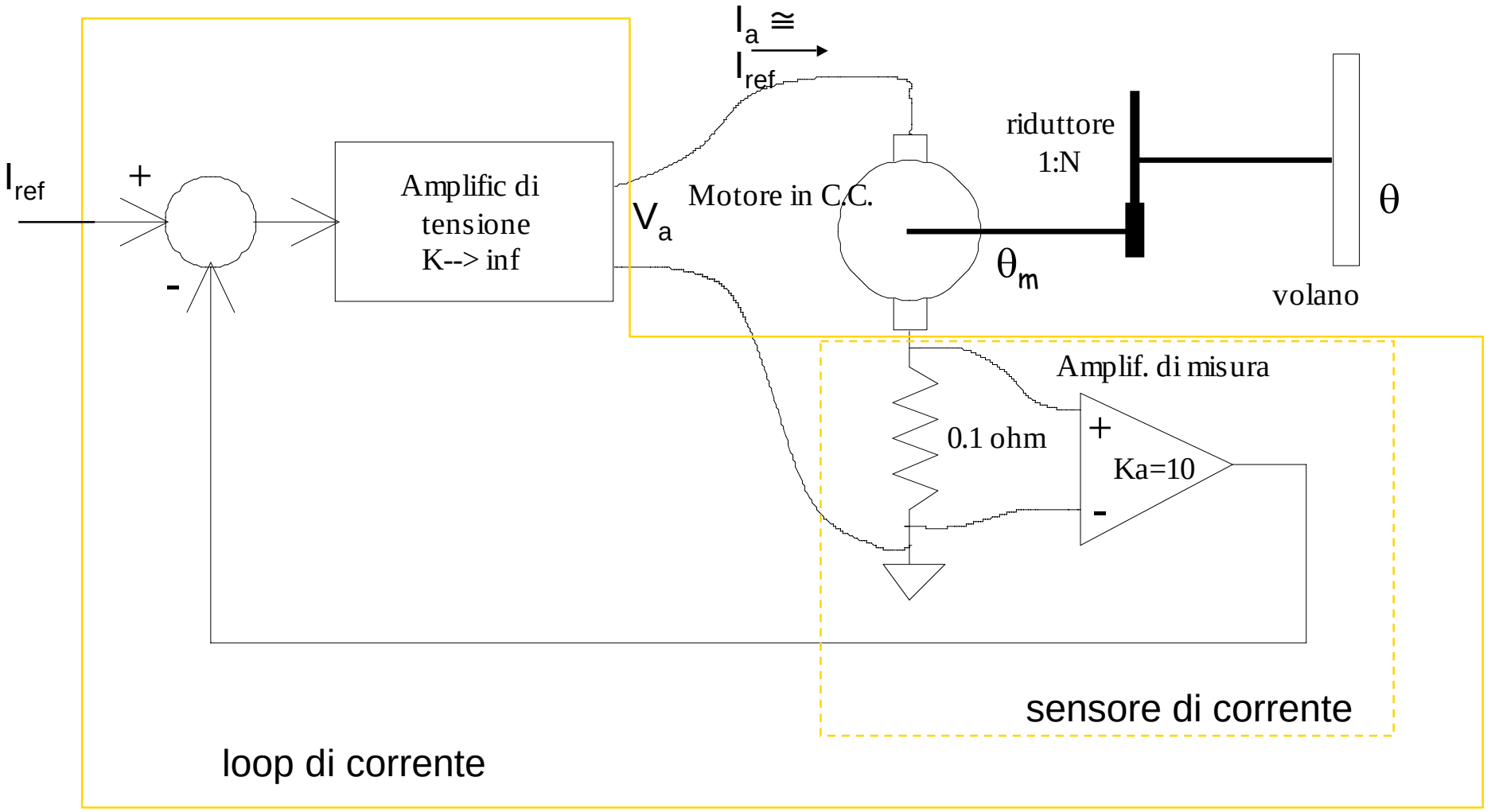
$$v_a = R_a i_a + L_a \frac{di_a}{dt} + K_e \omega$$

trasformando

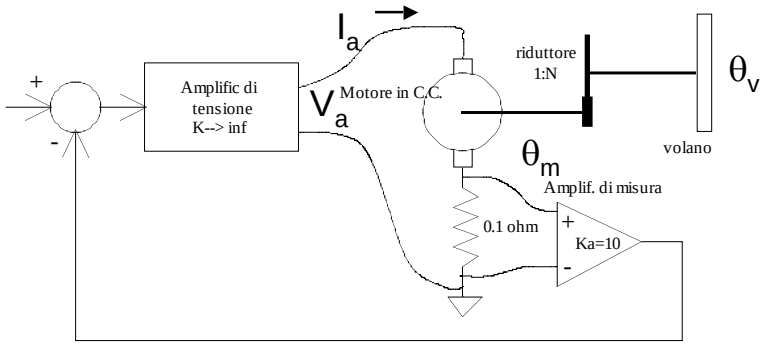
$$I_a(s) = \frac{1}{R_a + sL_a}(V_a(s) - K_e \Omega(s))$$

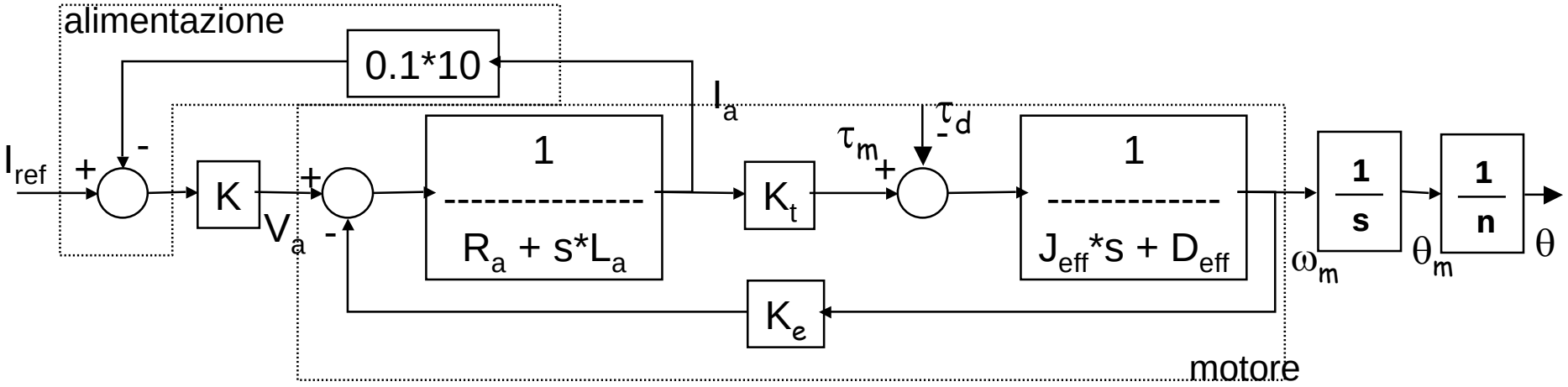
$$\tau_m(s) = K_t I_a(s)$$

controllo in corrente

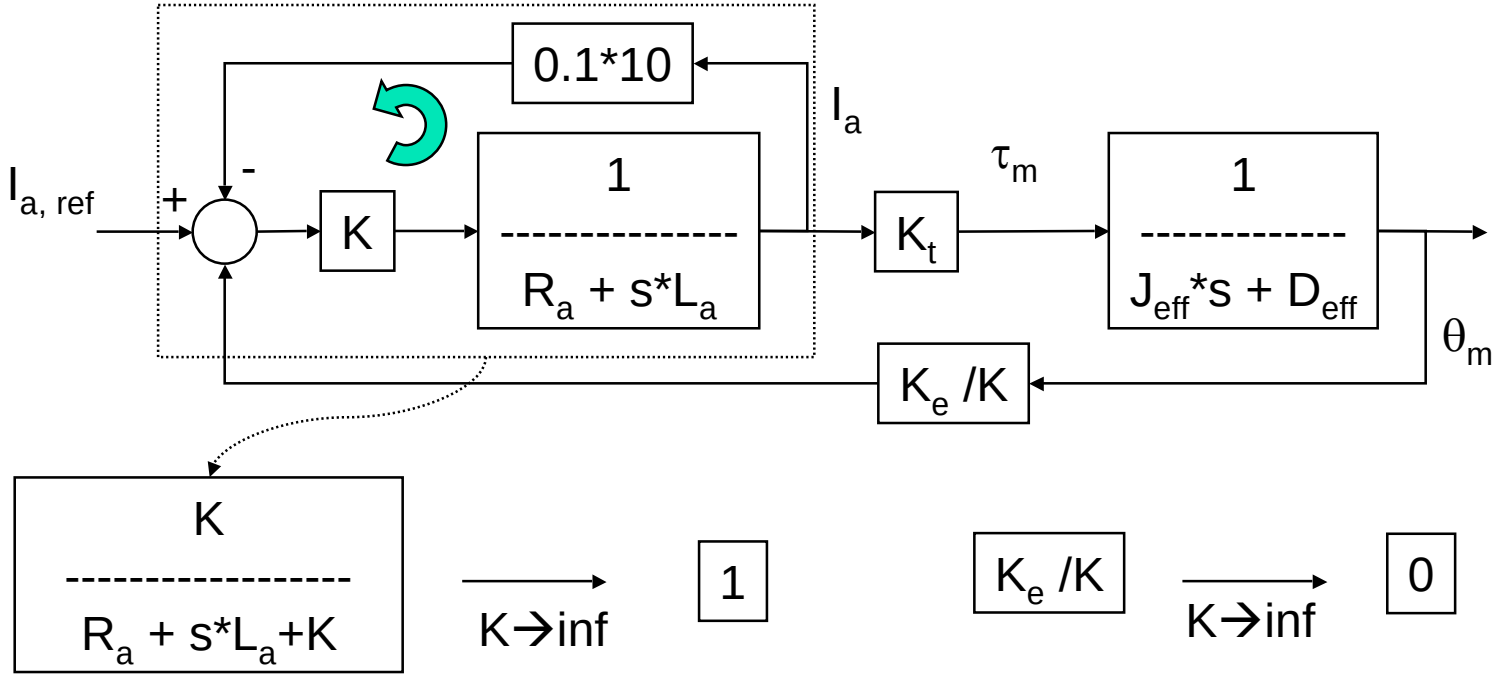


schema a blocchi

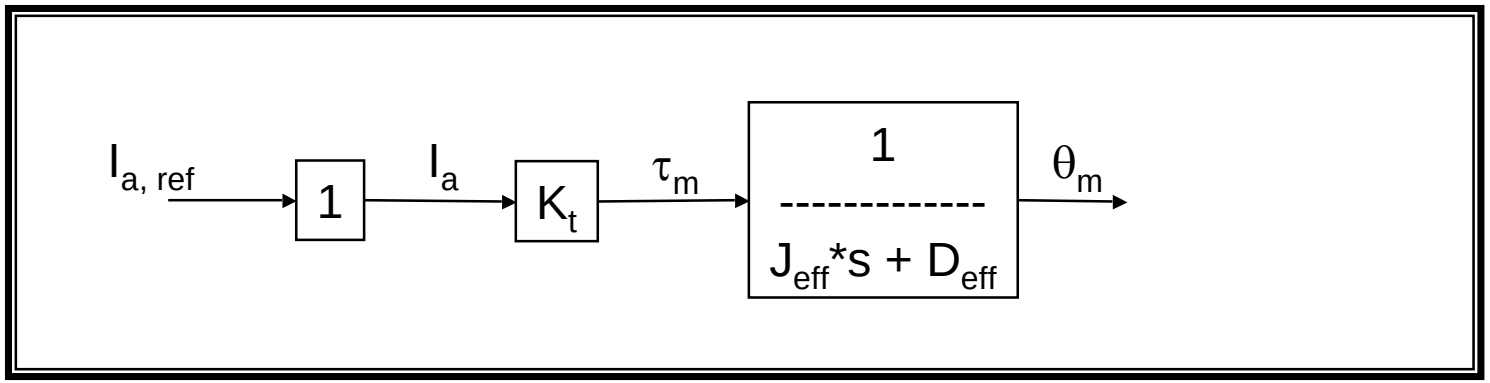




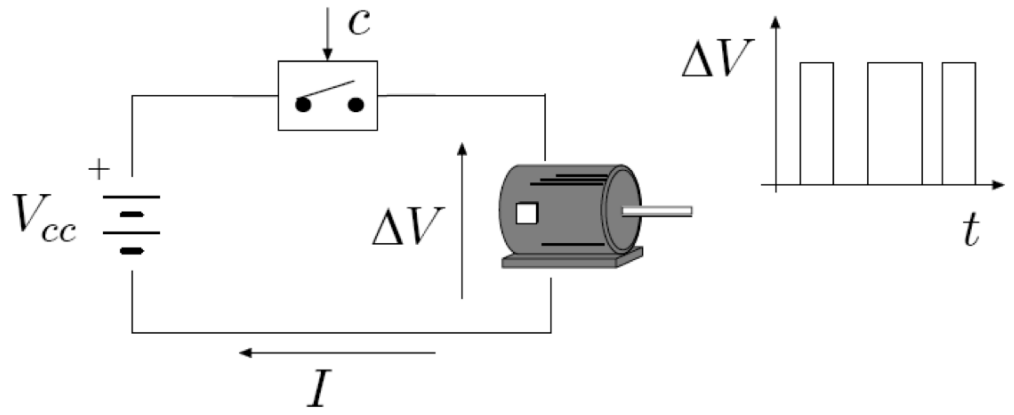
semplificazione



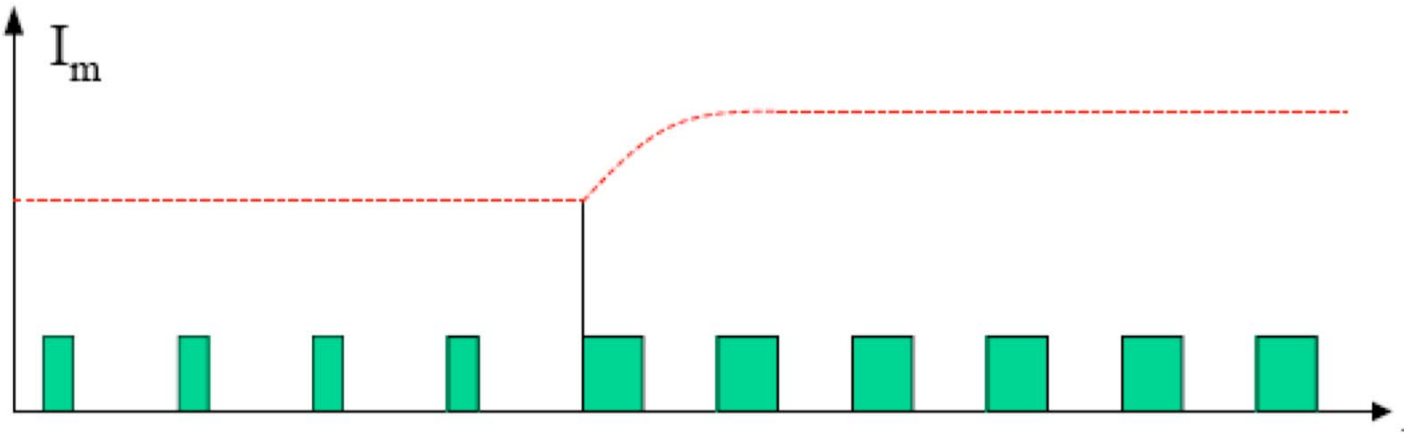
$$\frac{K}{R_a + s*L_a + K} \xrightarrow{K \to \infty} 1 \qquad K_e/K \xrightarrow{K \to \infty} 0$$



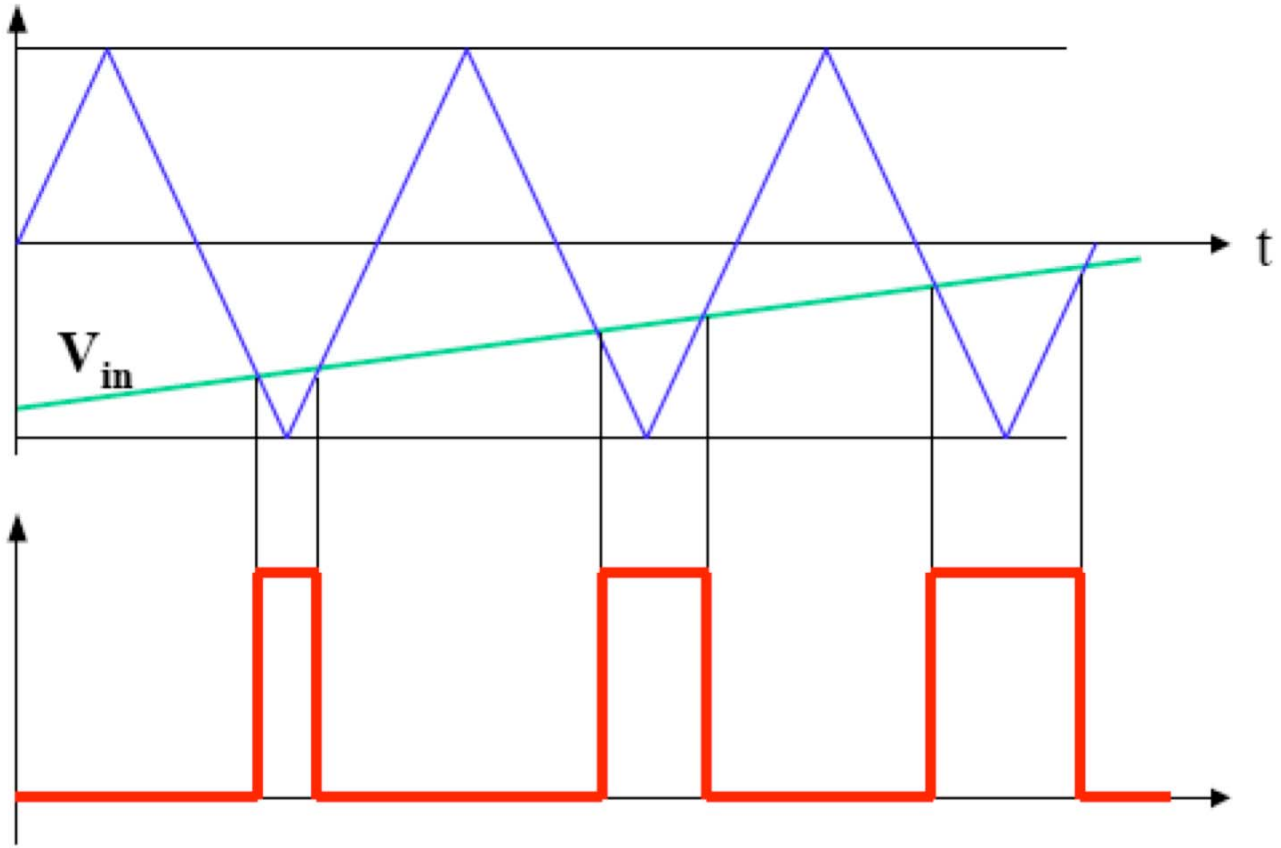
Pilotaggio PWM



idea se la frequenza è abbastanza elevata (KHz) la corrente media nell'induttore diventa costante e proporzionale al duty cycle del segnale

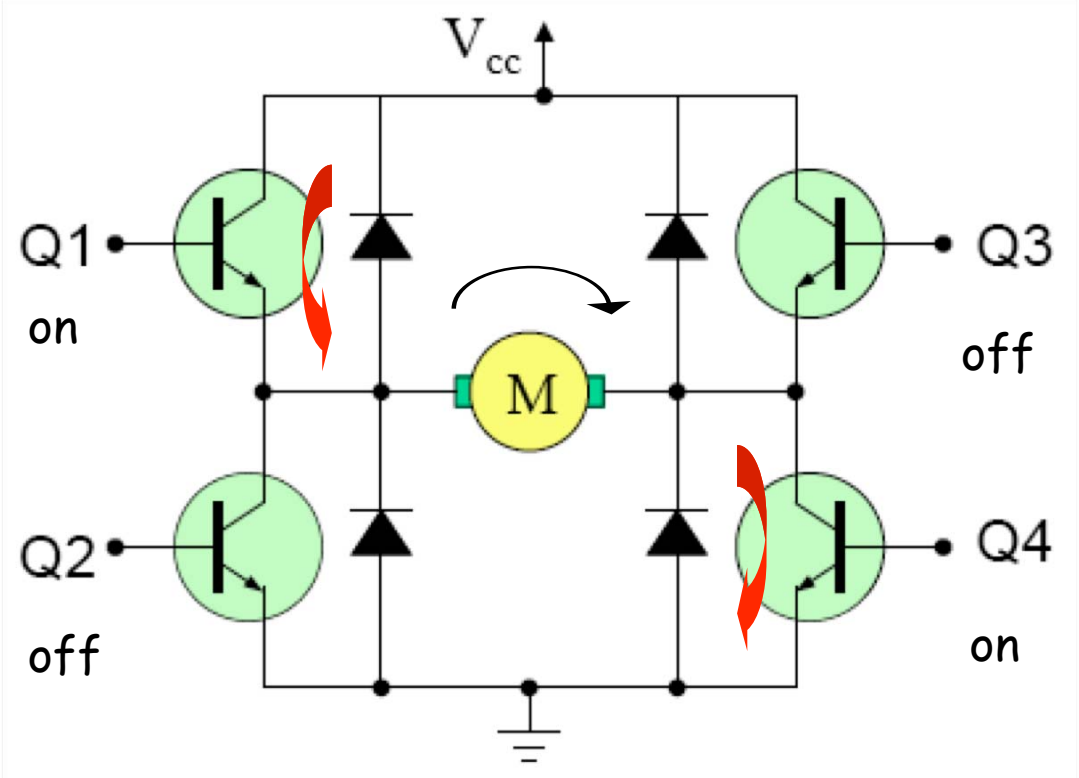


convertitore tensione-duty cycle



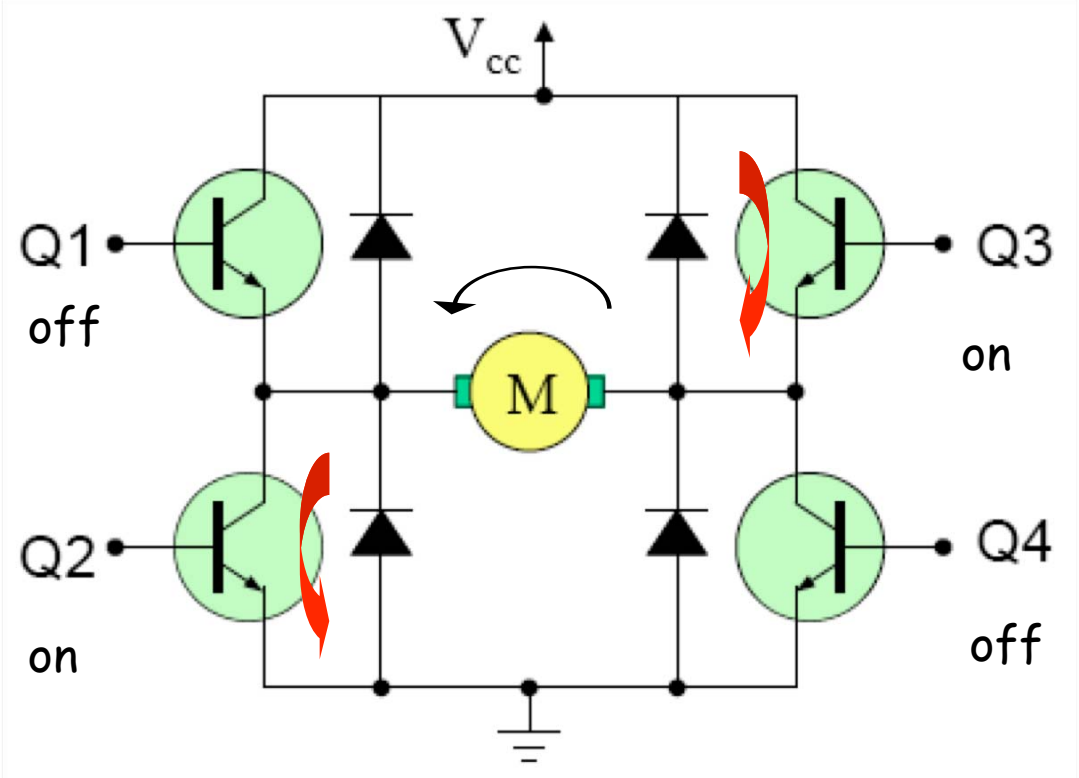
H-bridge

consente il controllo PWM bidirezionale



H-bridge

consente il controllo PWM bidirezionale



H-bridge

per ottenere le rotazioni giuste è necessaria un'apposita elettronica per pilotare i transistor