Equation de tension induite

$$u_1 = R_s i_1 + \frac{d\psi_{s1}}{dt}$$

$$\psi_{s1} = L_s i_1 + \psi_{e1}$$

$$\psi_{e1} = \Theta_e N \Lambda_{e1}$$

$$u_1 = R_s i_1 + L_s \frac{di_1}{dt} + \frac{\partial \Lambda_{e1}}{\partial \alpha} N \Theta_e \Omega$$

$\Theta_e = N_e i_e$ (bobinage)

$\Theta_e = \Theta_a = H_0 l_a$ (aimant)

Equation de tension induite

$$u_{i1} = \frac{\partial \Lambda_{e1}}{\partial \alpha} N \Theta_e \Omega$$

$$\Lambda_{e1} = -\widehat{\Lambda}_{es} \cos(p\alpha)$$

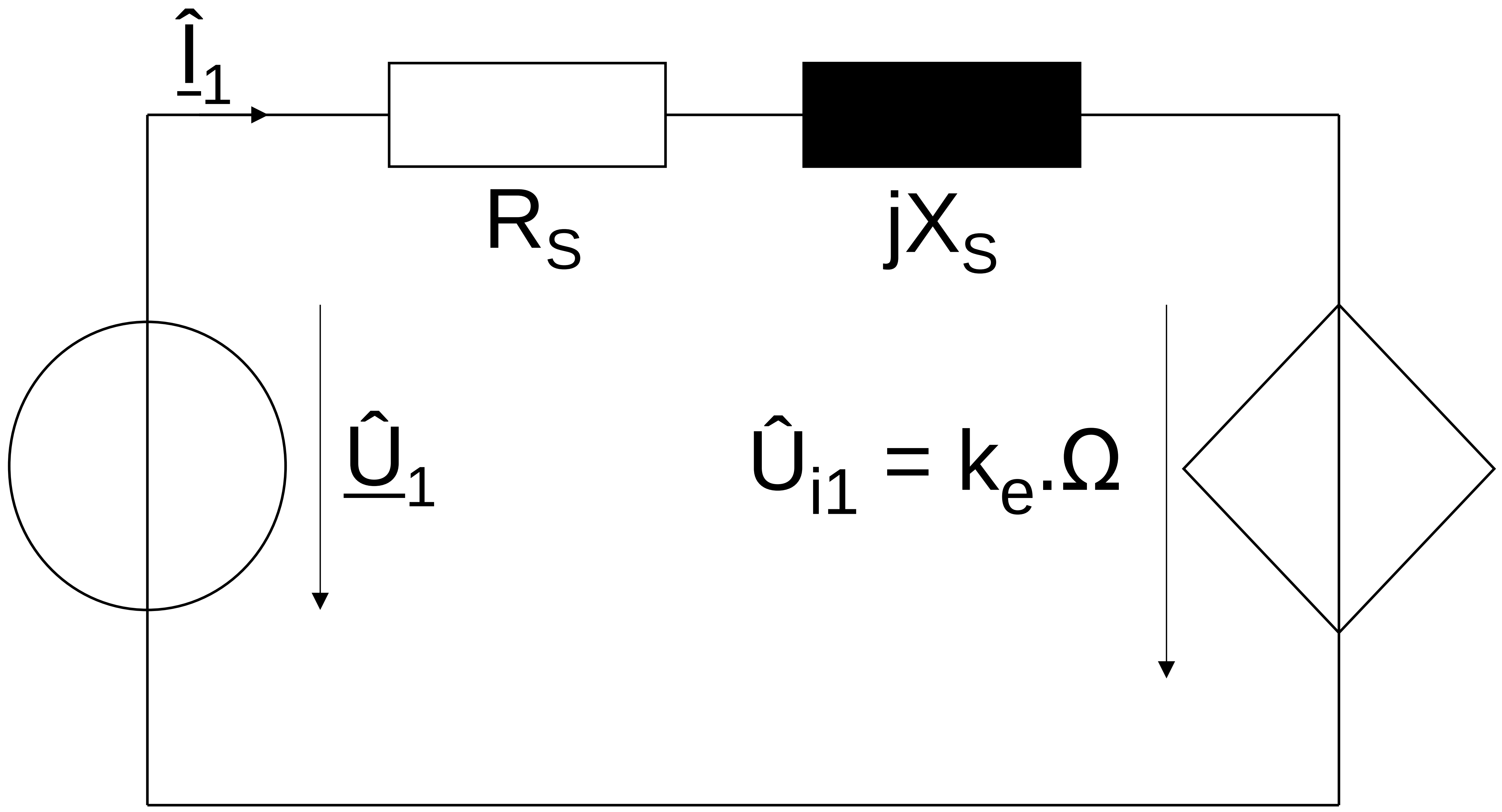
$$u_{i1} = p\widehat{\Lambda}_{es} N \Theta_e \Omega \sin(p\alpha) = k_e \Omega \sin(\omega t)$$

$$u_1 = R_s i_1 + L_s \frac{di_1}{dt} + \frac{\partial \Lambda_{e1}}{\partial \alpha} N \Theta_e \Omega$$

$$u_1 = R_s i_1 + L_s \frac{di_1}{dt} + k_e \Omega \sin(\omega t)$$

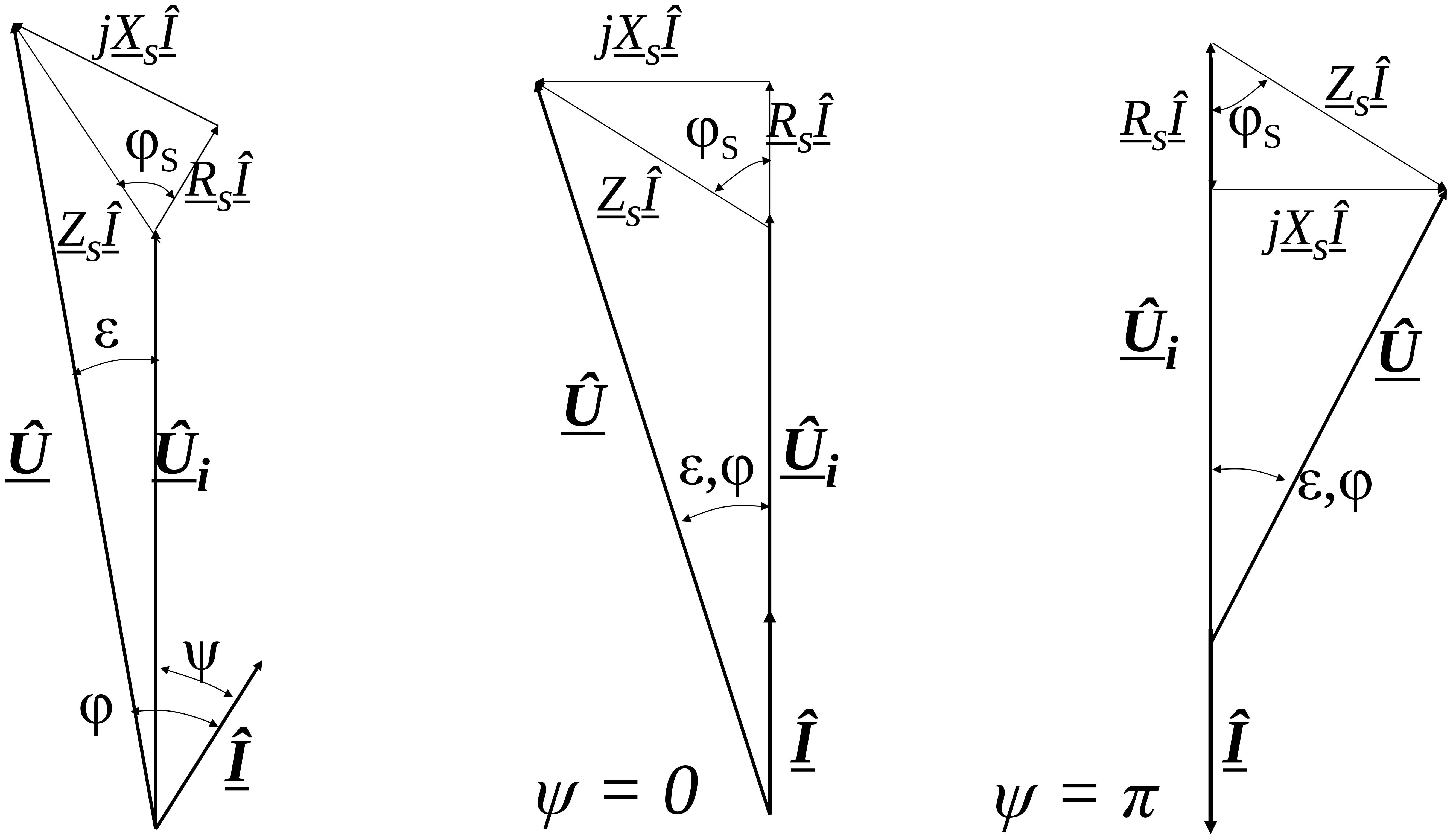
Ke: coefficient de tension induite [Vs]

Schéma équivalent



$$\hat{\underline{U}}_1 = R_s.\hat{\underline{I}}_1 + j\,X_s.\hat{\underline{I}}_1 + \hat{U}_{i1}$$

Diagramme tension - courant



$$\underline{\hat{U}} = R_s.\underline{\hat{I}} + j\,X_s.\underline{\hat{I}} + \hat{U}_i$$

Couple en régime sinusoïdal

Source de courant

$$M = 3/2\ k_e.\hat{I}_1.\cos\psi$$

Source de tension

$$M = 3/2\ k_e/Z_s.[\hat{U}_s.\cos(\varphi_s - \varepsilon) - k_e.\Omega.\cos\varphi_s]$$

Circuit ouvert

$$M = 3/2\ k_e/Z_s.[\hat{U}_s.\cos(\varphi_s - \varepsilon) - k_e.\Omega.\cos\varphi_s] = M_r$$

Auto-commuté

$$M = 3/2\ k_e/Z_s.[\hat{U}_s.\cos(\varphi_s - \varepsilon) - k_e.\Omega.\cos\varphi_s] = M_r$$

Choix pour l'autocommutation

- Alimentation en courant: $M = 3/2\ k_e.\hat{I}_1.\cos\psi$
- Alimentation en tension: $M = 3/2\ k_e/Z_s.[\hat{U}_s.\cos(\varphi_s - \varepsilon) - k_e.\Omega.\cos\varphi_s]$
- Alimentation en tension: maximum de couple

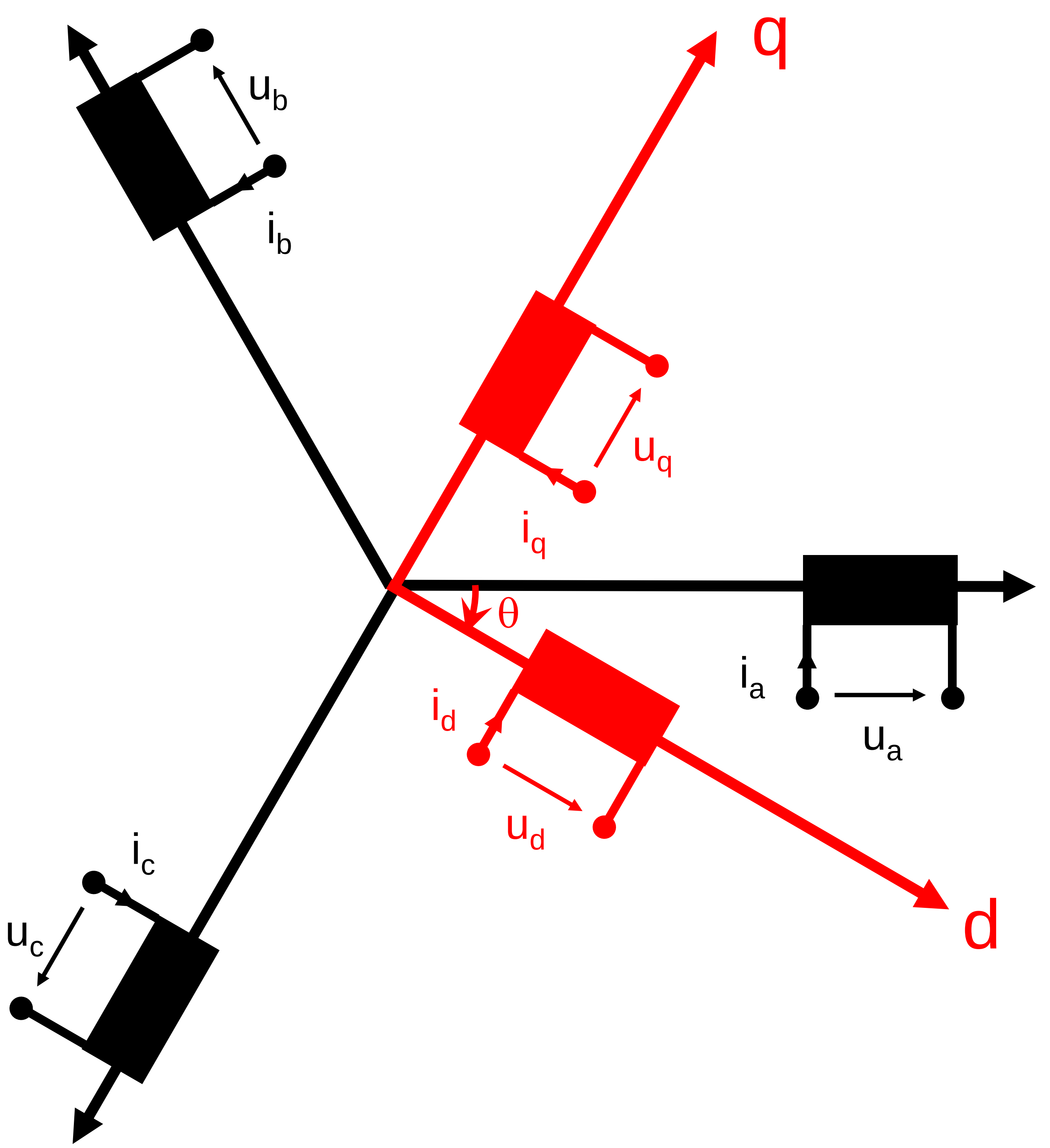
$$\epsilon = \varphi_s$$

- Alimentation en tension: maximum de rendement

$$\epsilon = \mathrm{acos}\left(k_e \Omega \frac{\omega L_s}{Z_s \hat{U}_s}\right) - \mathrm{atan}\frac{R_s}{\omega L_s}$$

- Alimentation en tension: angle de commutation fixe

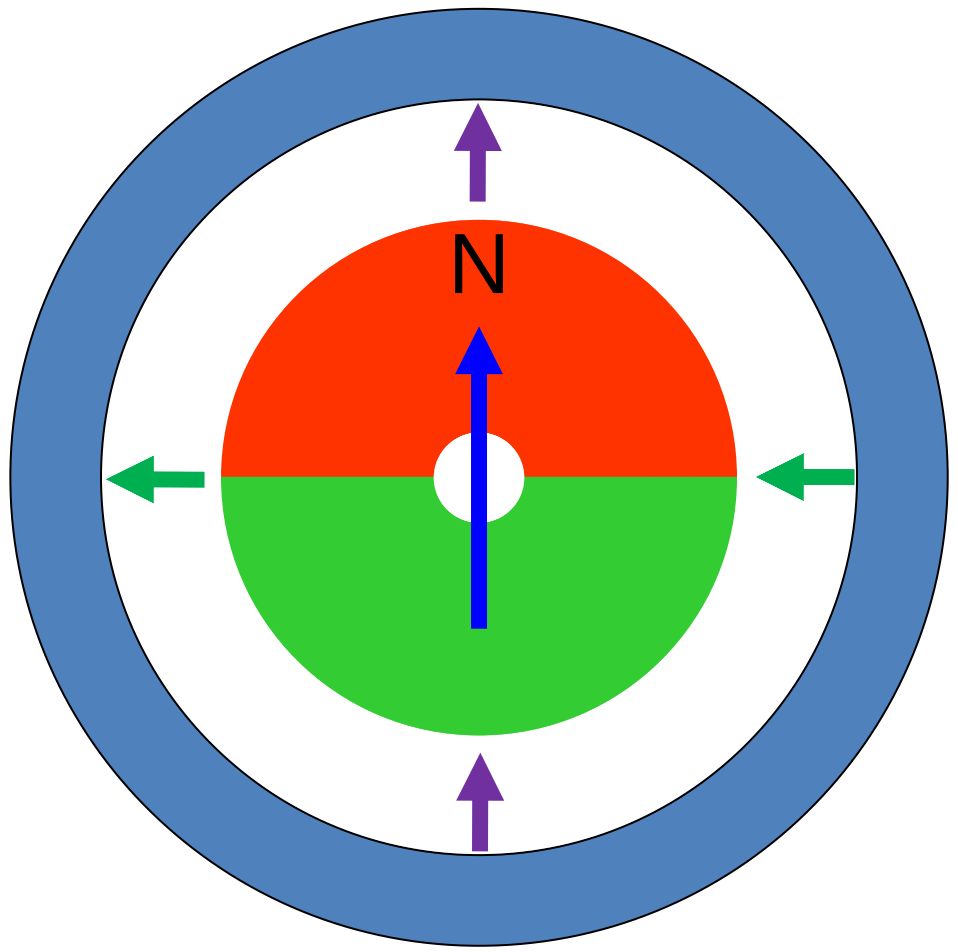
Transformation de Park



$$\begin{bmatrix} i_d \\ i_q \\ i_o \end{bmatrix} = \frac{2}{3} \begin{bmatrix} \cos\theta & \cos\left(\theta - \frac{2\pi}{3}\right) & \cos\left(\theta + \frac{2\pi}{3}\right) \\ -\sin\theta & -\sin\left(\theta - \frac{2\pi}{3}\right) & -\sin\left(\theta + \frac{2\pi}{3}\right) \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix}$$

$$\begin{bmatrix} \psi_d \\ \psi_q \\ \psi_o \end{bmatrix} = \frac{2}{3} \begin{bmatrix} \cos\theta & \cos\left(\theta - \frac{2\pi}{3}\right) & \cos\left(\theta + \frac{2\pi}{3}\right) \\ -\sin\theta & -\sin\left(\theta - \frac{2\pi}{3}\right) & -\sin\left(\theta + \frac{2\pi}{3}\right) \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix} \begin{bmatrix} \psi_a \\ \psi_b \\ \psi_c \end{bmatrix}$$

Contrôle vectoriel



i_d:axe direct

i_q:axe transverse

$$M = \frac{3}{2} \mathrm{p} \Psi_d i_q$$