2.4 Het asynchroon ideaal motorprincipe

2.4.1. Algemeen

Transformator	ASM	
PRIM	STATOR →	DRAAIVELD
SEC	ROTOR →	STROOMVOERENDE GELEIDERS
/	LUCHTSPLEET	
SIN. VELD	DRAAIVELD	

3F. TRANSFO
SEC kortgesloten

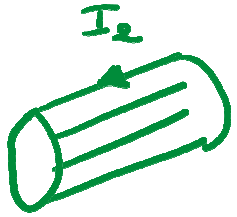
2.4 Het asynchroon ideaal motorprincipe

2.4.1. Algemeen

Ideaal

- Stator : - 3 ideale spoelen
  - geen lekflux $X_s = 0$
  - geen ohmse weerst $R_s = 0$

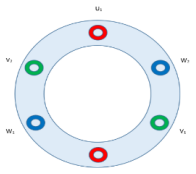
- Rotor : - ideale OHMSE kortsluiting
  - geen sec. lekflux $X_2 = 0$
  - geen ohmse weerst $R_2 = 0$

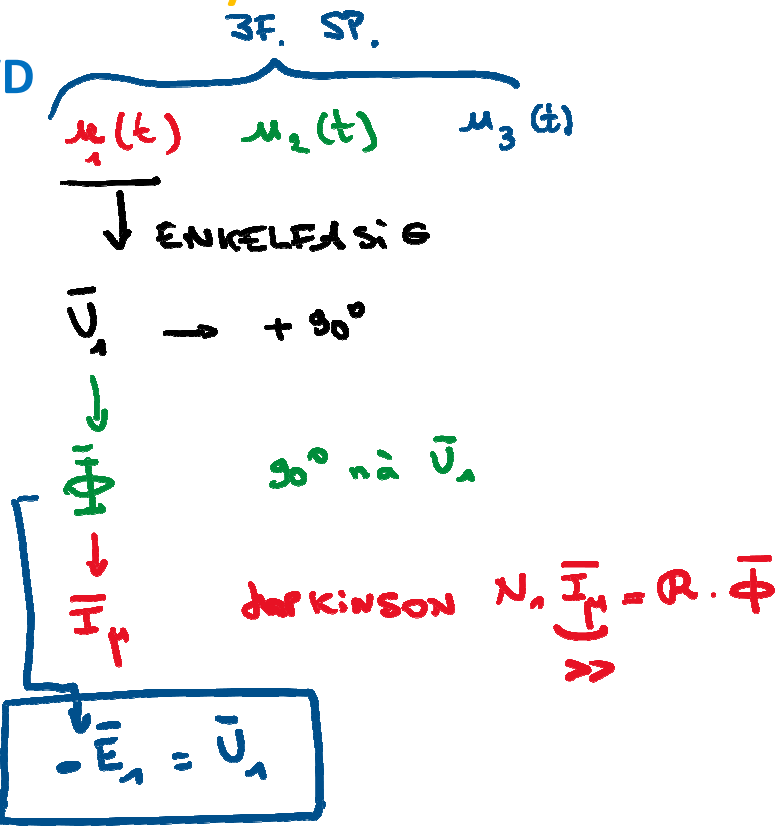


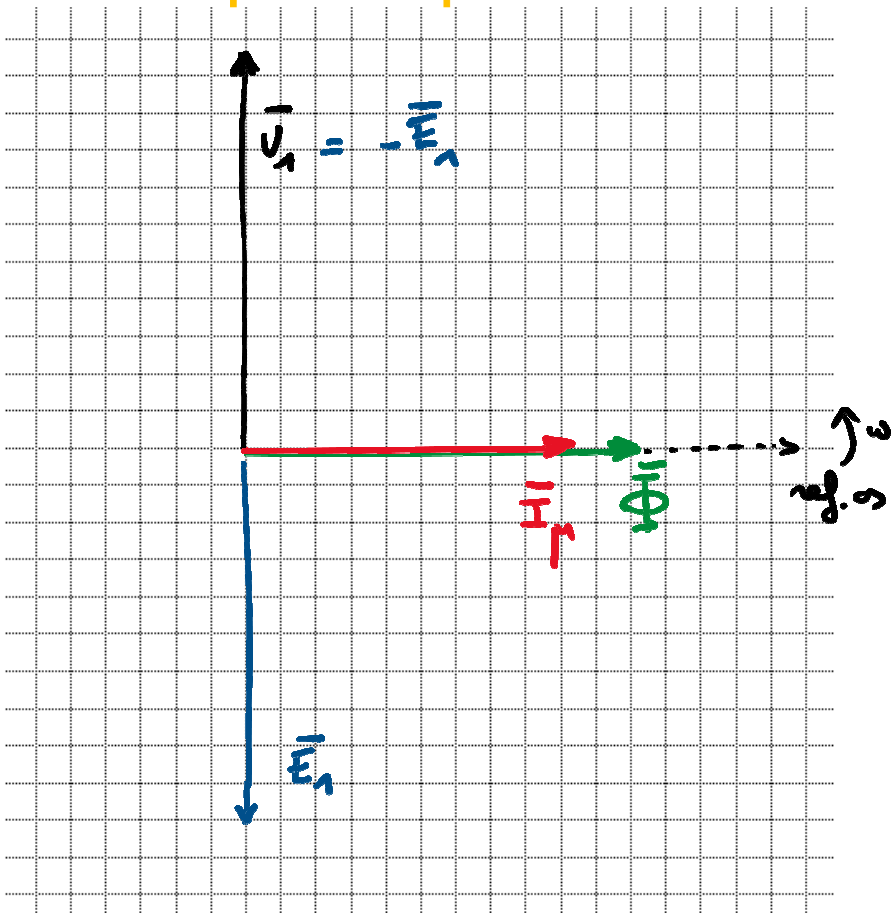
- FERROMAGN $\begin{cases} P_{Fe} = P_H + P_{WS} = 0 \\ \text{lineaire ben} \ll \text{ver2.} \end{cases}$

2.4 Het asynchroon ideaal motorprincipe

2.4.2. VD Stator







2.4.2. VD
Rotor

$\bar{E}_2$ $\quad k = 1$

↓ $\bar{E}_2$ · ohmse kortsluiting

$\bar{I}_2$

↓ N_2 HOPKINSON

$\bar{\Phi}_2$ in fase $\bar{I}_2$

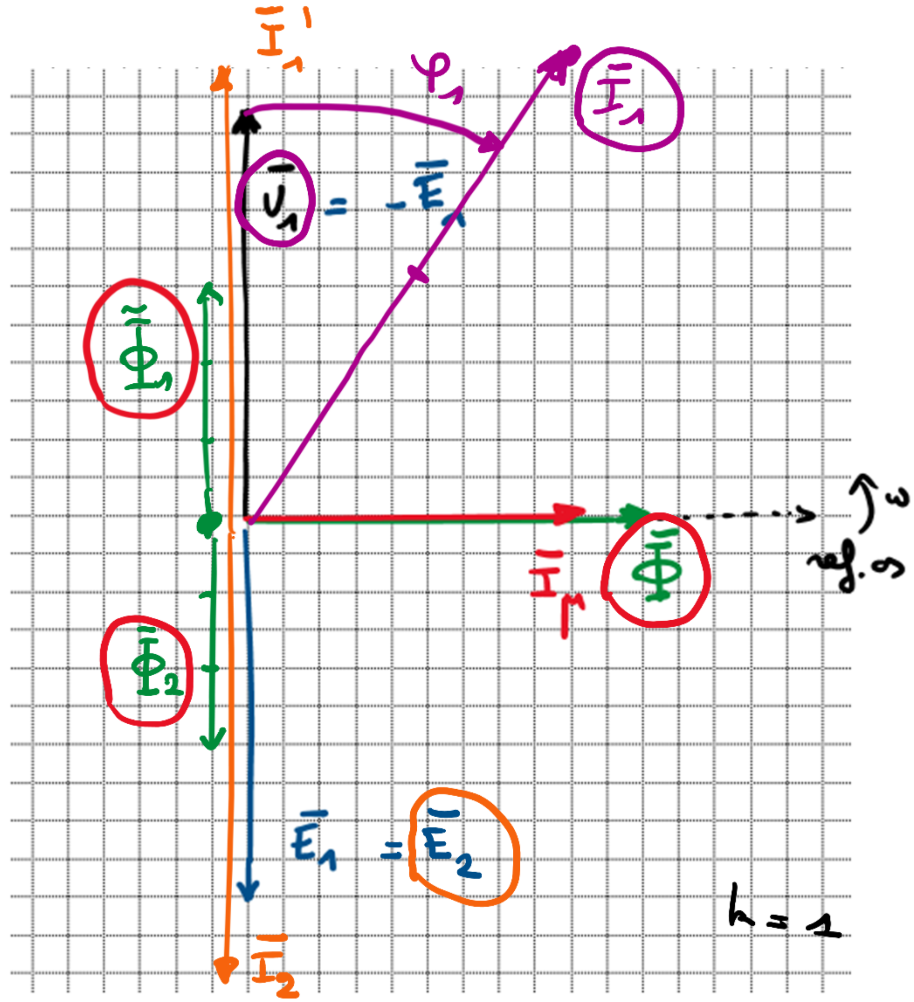
↓ $\underbrace{V_1 = E_1}_{cte} = 4{,}44\, N_{1s}\, \underbrace{f_s}_{cte}\, \Phi \rightarrow cte$

$\bar{\Phi}_1 = -\bar{\Phi}_2$

↓ N_1 HOPKINSON

$\bar{I}_1' = -\bar{I}_2 \quad k = 1$

↓ $\bar{I}_1 = \bar{I}_\mu + \bar{I}_1'$



L. Butaye

2.4.2. VD
Besluit

V.D → MOTOR → POS. ENERGIE STROOM

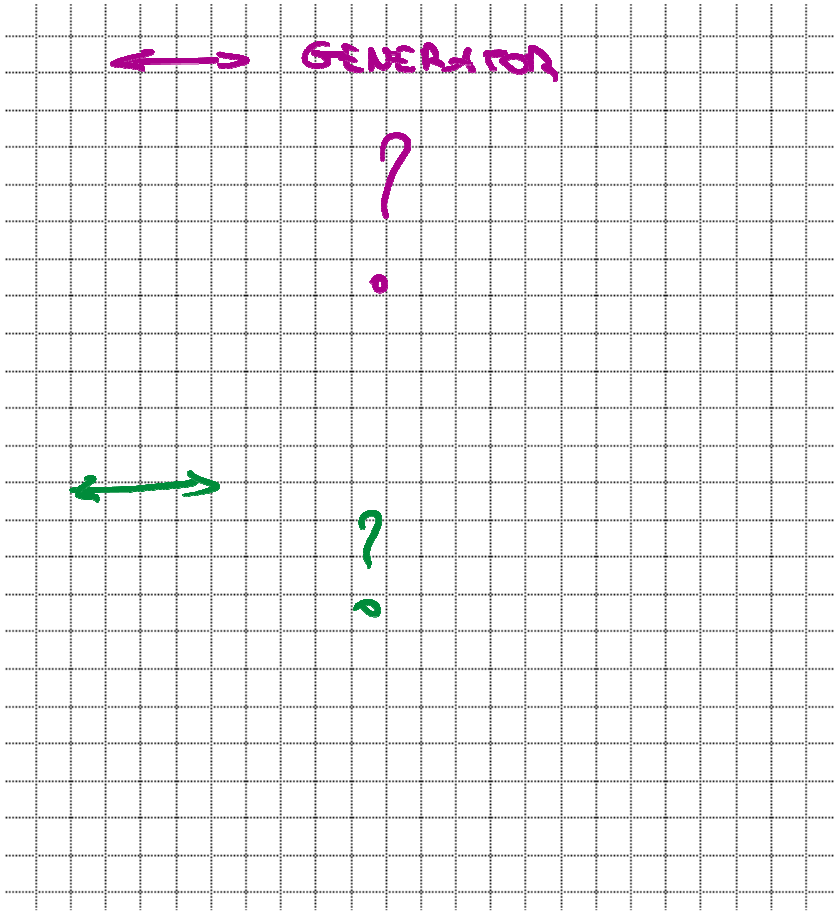
Als $\varphi_1 > 0$

$0 < \varphi_1 < 90°$

→ Ideale T !!

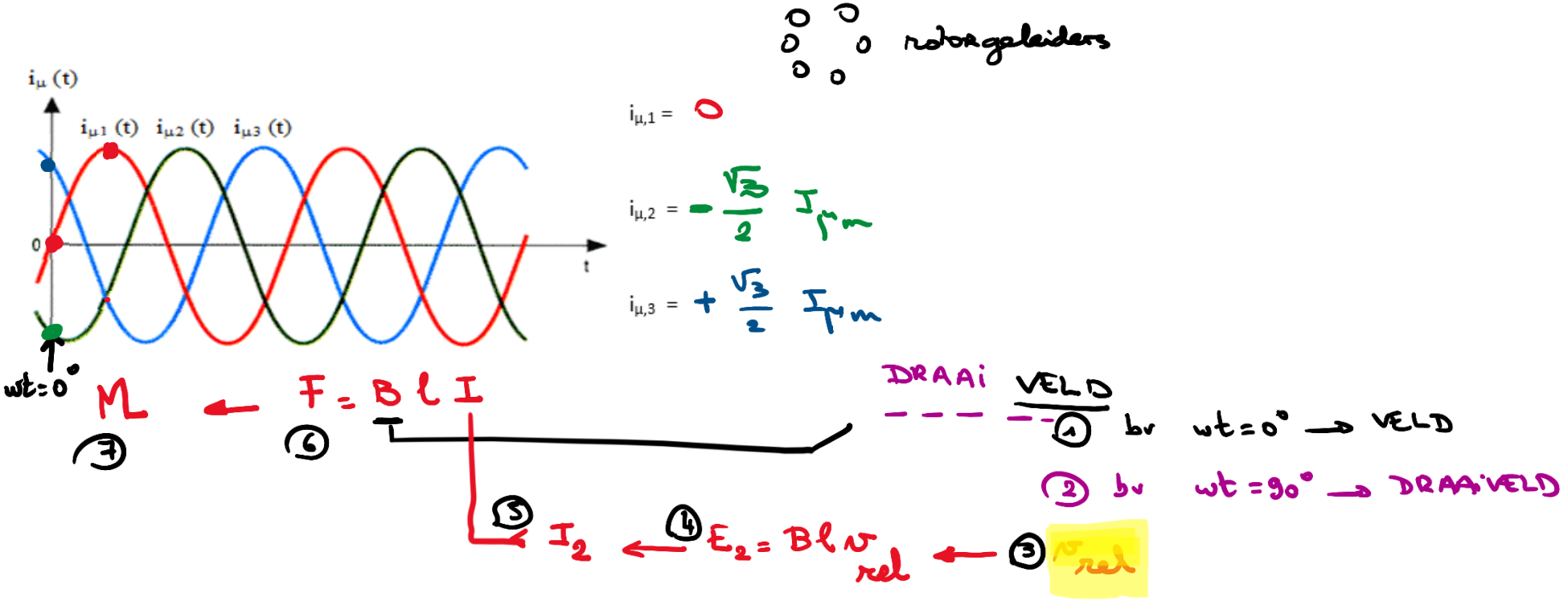
$\underline{\Phi}_1$ 90° voor $\underline{\Phi}$ 90° voor $\underline{\Phi}_2$

$\underline{I}_1'$ $\underline{I}_2$



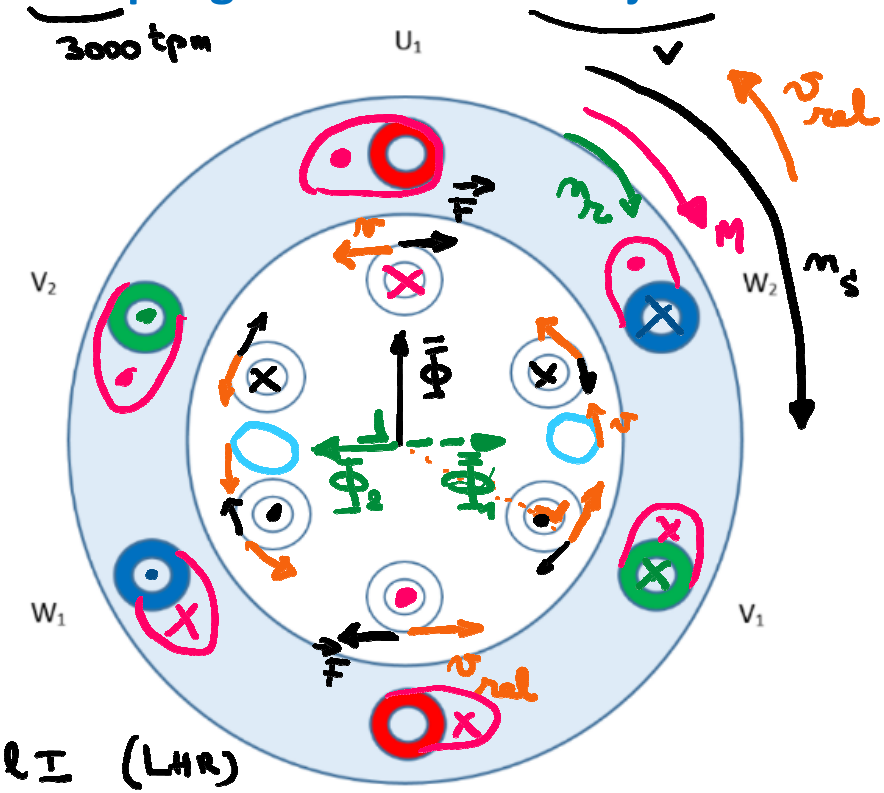
2.4 Het asynchroon ideaal motorprincipe

2.4.3. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 0°



2.4 Het asynchroon ideaal motorprincipe

2.4.3. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 0°



$i_{\mu,1}$ = 0

$i_{\mu,2}$ < 0

$i_{\mu,3}$ > 0

① VELD ωt=0°

② DRAAIVELD

③ n_s

$v_{rel} = -n_s$

ontrakselheid ⊥ R

④ $E_2 = B l v_{rel}$ RHR

⑤ I_2

0 $B \parallel v_{rel} \rightarrow E_2 = 0 \rightarrow I_2 = 0$

× • $\rightarrow B \perp v_{rel} \rightarrow E_{2max}$

⑥ $F = B l I$ (LHR)

⑦ M ⊕ → ⑧ U_2 n_r ⊕ I

I ∝ → ⑨ Φ_2

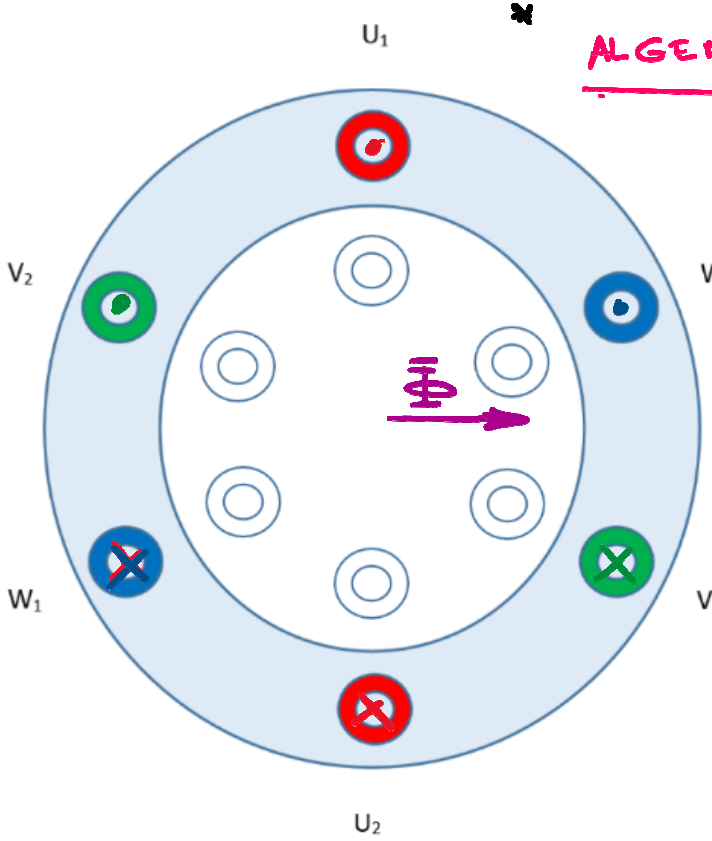
⑩ $\Phi_1 = \Phi_2$

⑪ I_r

ωt = 90°

2.4 Het asynchroon ideaal motorprincipe

2.4.3. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 0°



$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =

ALGEMEEN BESLUIT

② V.D. $\bar{\Phi}_1$ 90° van $\bar{\Phi}$ 90° van $\bar{\Phi}_2$ ω

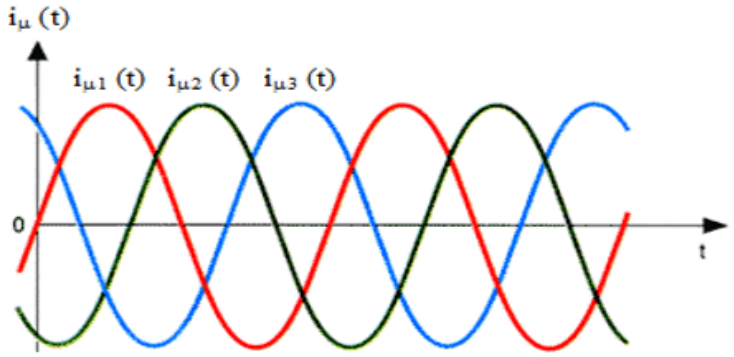
Bol.fig " " "

② * M + ⇢ n_2 + ⇒ H (M)

M − en n_2 − H (M)

2.4 Het asynchroon ideaal motorprincipe

2.4.4. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 90°



$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =

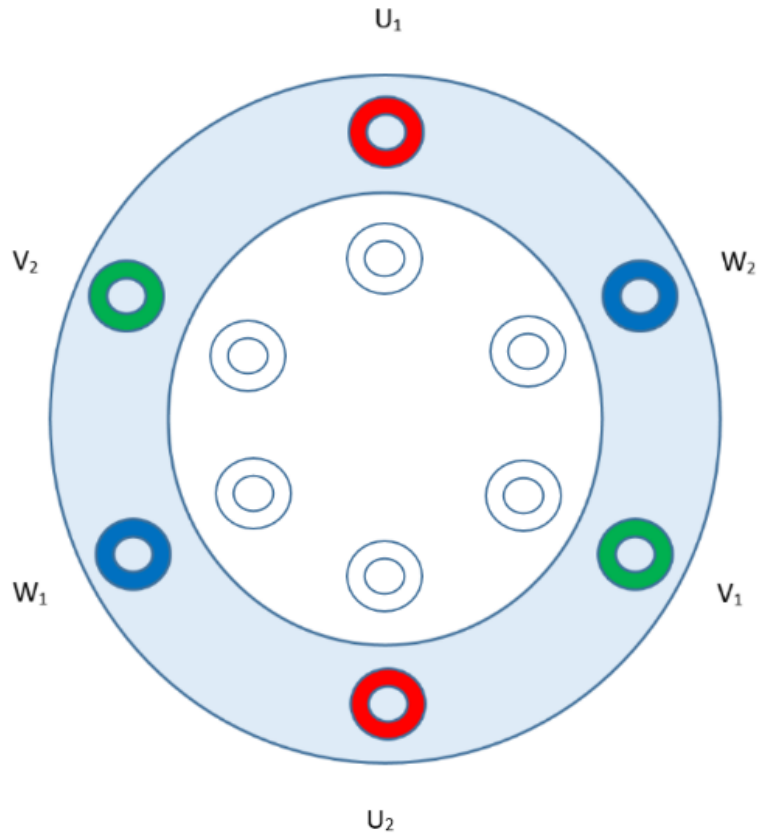
2.4 Het asynchroon ideaal motorprincipe

2.4.4. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 90°

$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =



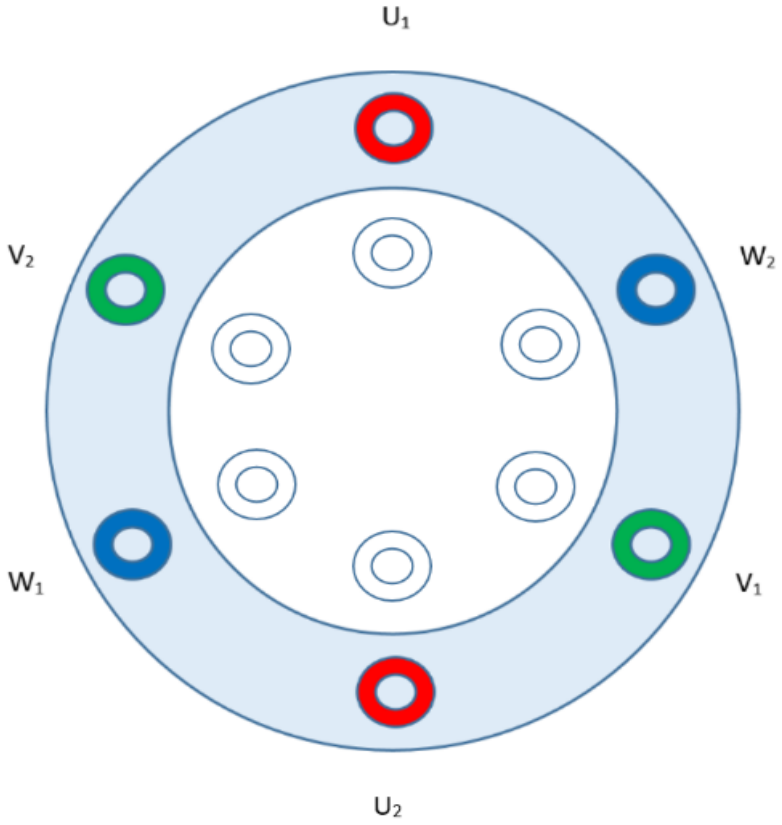
2.4 Het asynchroon ideaal motorprincipe

2.4.4. Tweepolig draaiveld – uurwijzerzin – motor – ωt = 90°

$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =



2.5 Het asynchroon ideaal generatorprincipe

2.5.1. Algemeen

VW → P.

GENERATOR → $n_r > n_s$

SYNCHROON TOERENTAL

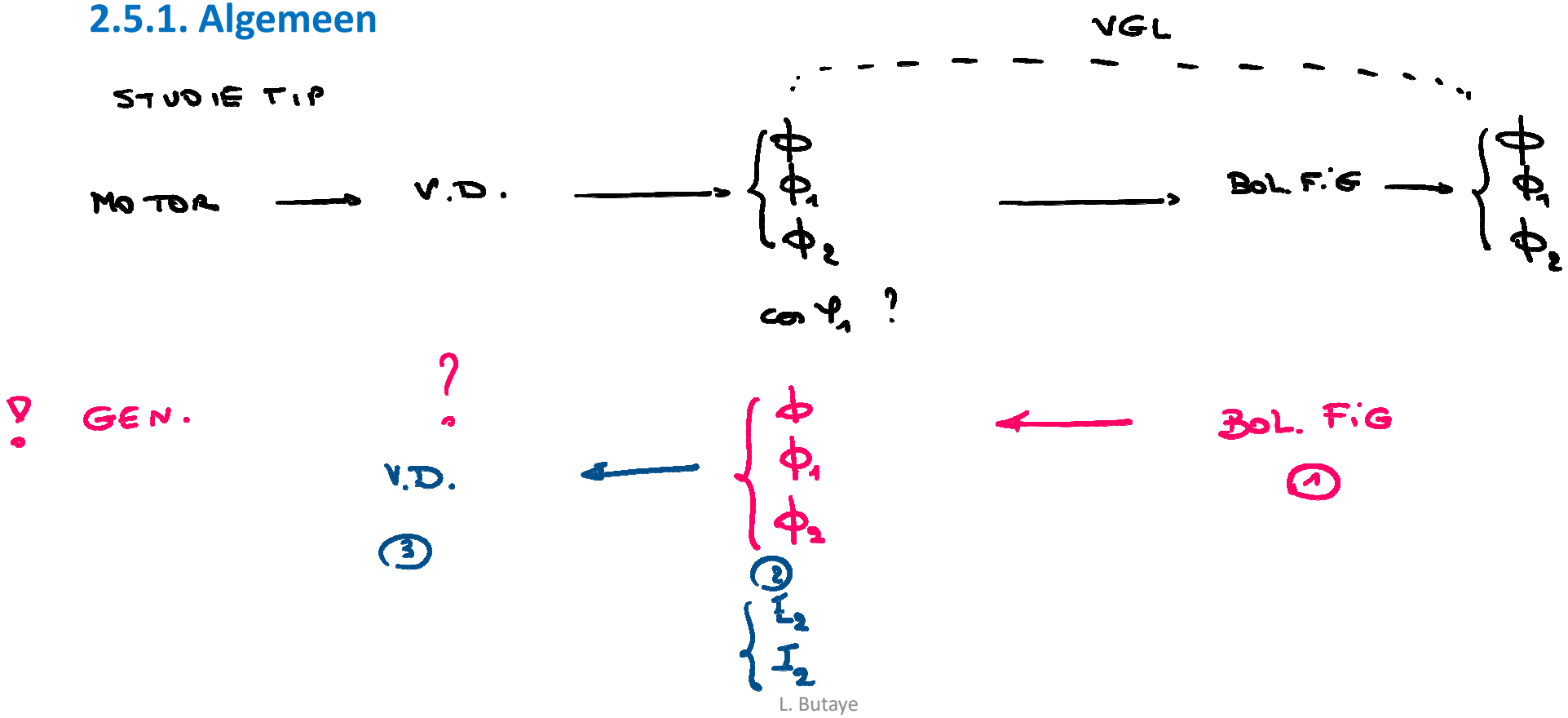
$$n_s = \frac{60 f_s}{p}$$

DRAAIVELD

→ n_s < n_r dezelfde zin

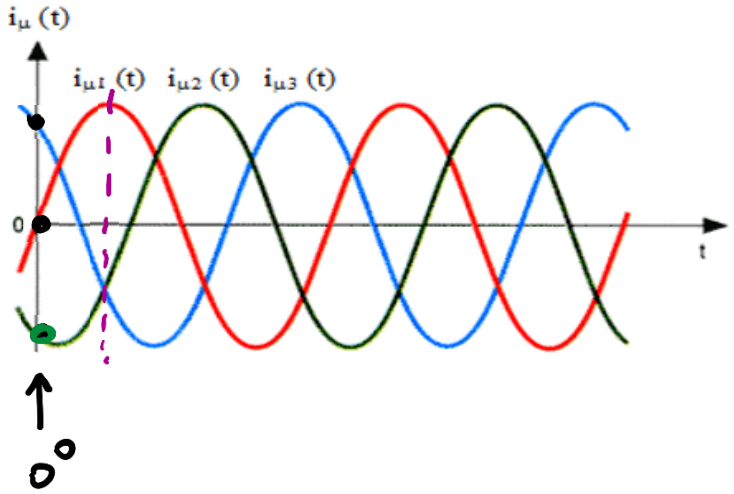
2.5 Het asynchroon ideaal generatorprincipe

2.5.1. Algemeen



2.5 Het asynchroon ideaal generatorprincipe

2.5.2. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 0°



wt = 0°

$i_{\mu,1}$ = 0

$i_{\mu,2}$ = < 0

$i_{\mu,3}$ = > 0

wt = 90°

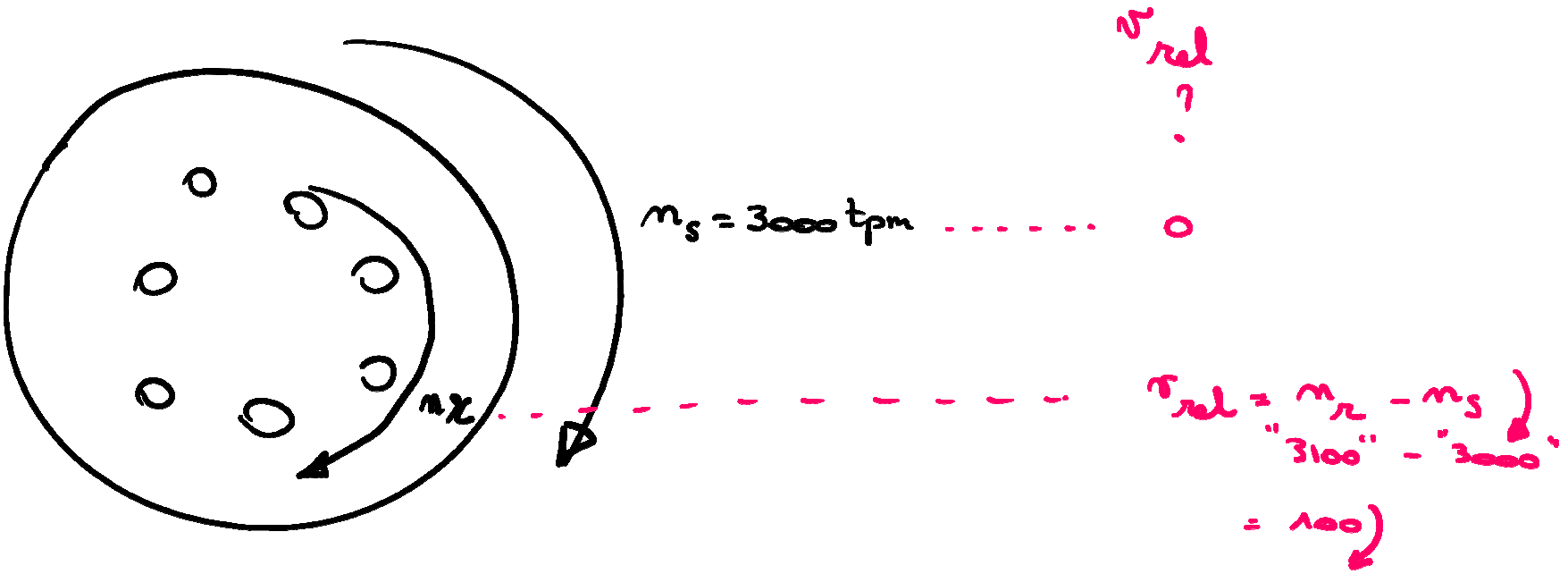
$i_{\mu,1}$ > 0

< 0

< 0

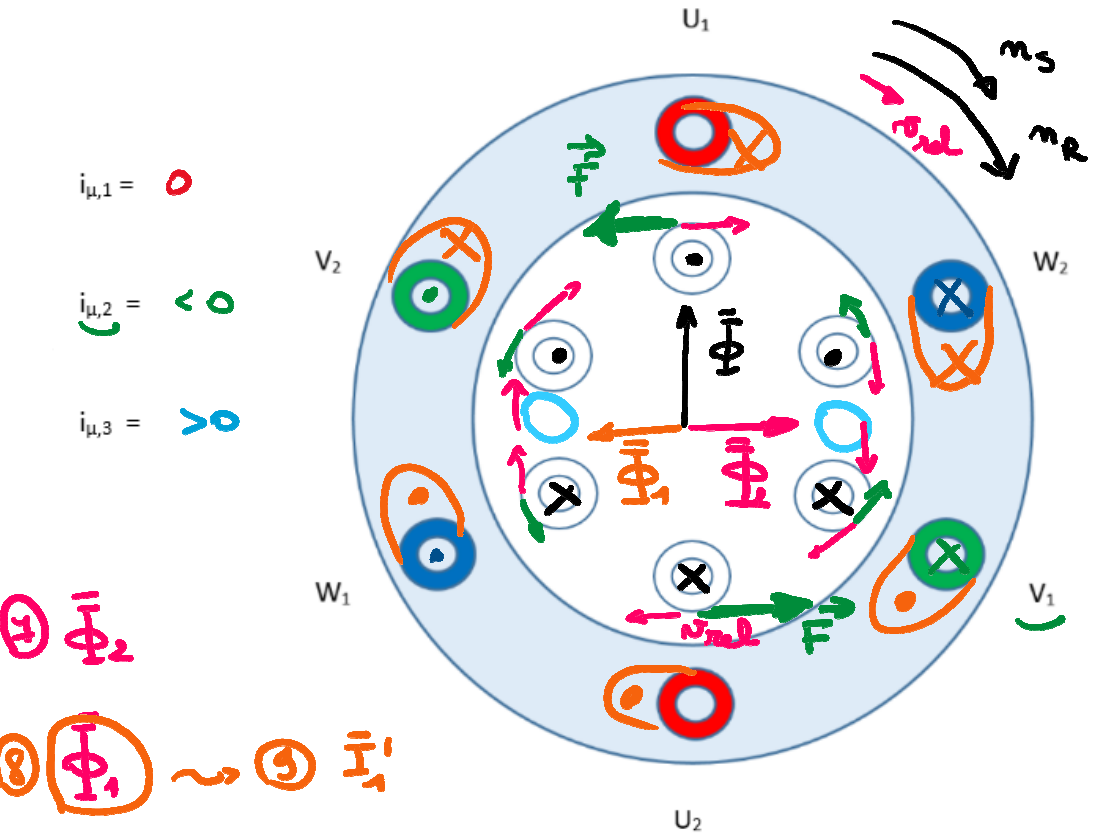
2.5 Het asynchroon ideaal generatorprincipe

2.5.2. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 0°



2.5 Het asynchroon ideaal generatorprincipe

2.5.2. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 0°



① $\bar{I}$ $\bar{\Phi}_2$

② $\bar{\Phi}_1$ ~ ③ $\bar{I}_1'$

① VELD $\omega t = 0°$ ↑

② DRAAI VELD $\omega t = 90°$ →

⇒ n_s ↓

③ n_{rel} ↓ .... omgepoold (M)

④ $E_2 = B l n_{rel}$ → I_2

↳ ○ B // n → $E_2 = 0$ → $I_2 = 0$

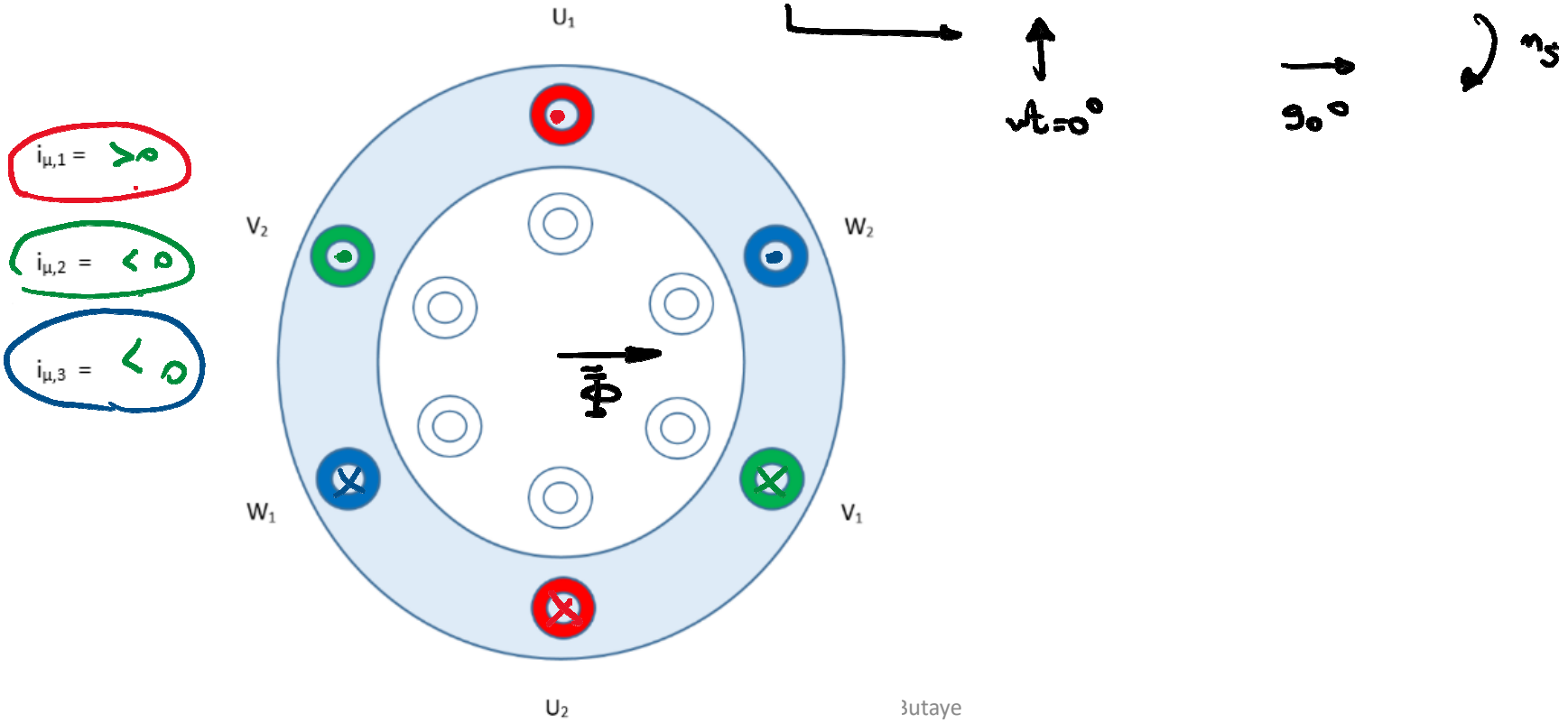
⇒ VGL (M) E_2 omgepoold
I_2

⑤ $F = B L I_2$ (Lina)

⑥ M ↻ ↓ n_R ↑ → II

2.5 Het asynchroon ideaal generatorprincipe

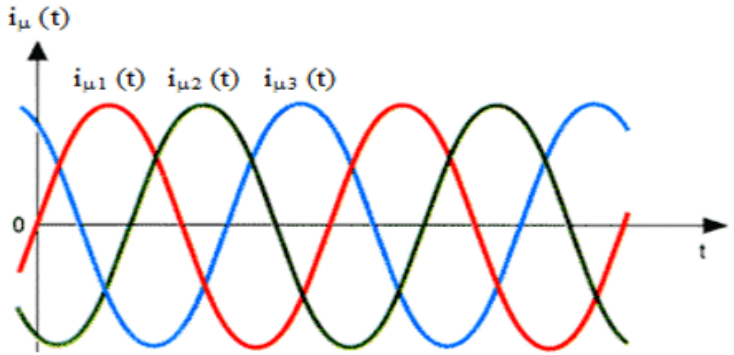
2.5.2. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 0° 90°



Butaye

2.5 Het asynchroon ideaal generatorprincipe

2.5.3. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 90°



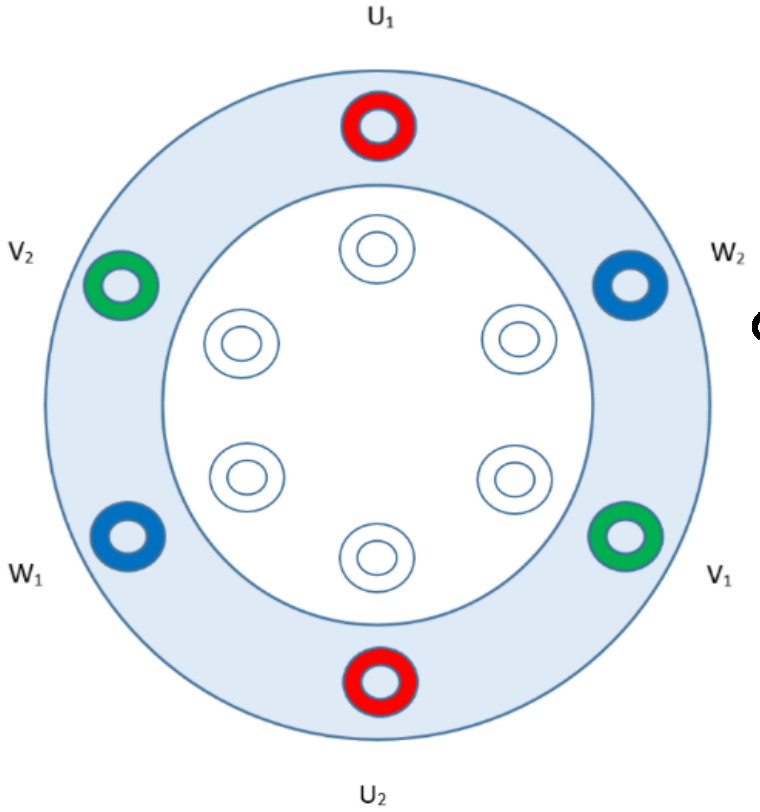
$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =

2.5 Het asynchroon ideaal generatorprincipe

2.5.3. Tweepolig draaiveld – uurwijzerzin – generator – ωt = 90°



$i_{\mu,1}$ =

$i_{\mu,2}$ =

$i_{\mu,3}$ =

BESLUIT

① $\bar{\Phi}_2$ 90° van $\bar{\Phi}$ 90° van $\bar{\Phi}_1$

② $\bar{E}_2$ $\bar{I}_2$ omgepraald tot MOTOR

3F. SYSTEEM

2.5 Het asynchroon ideaal generatorprincipe

2.5.2. VD

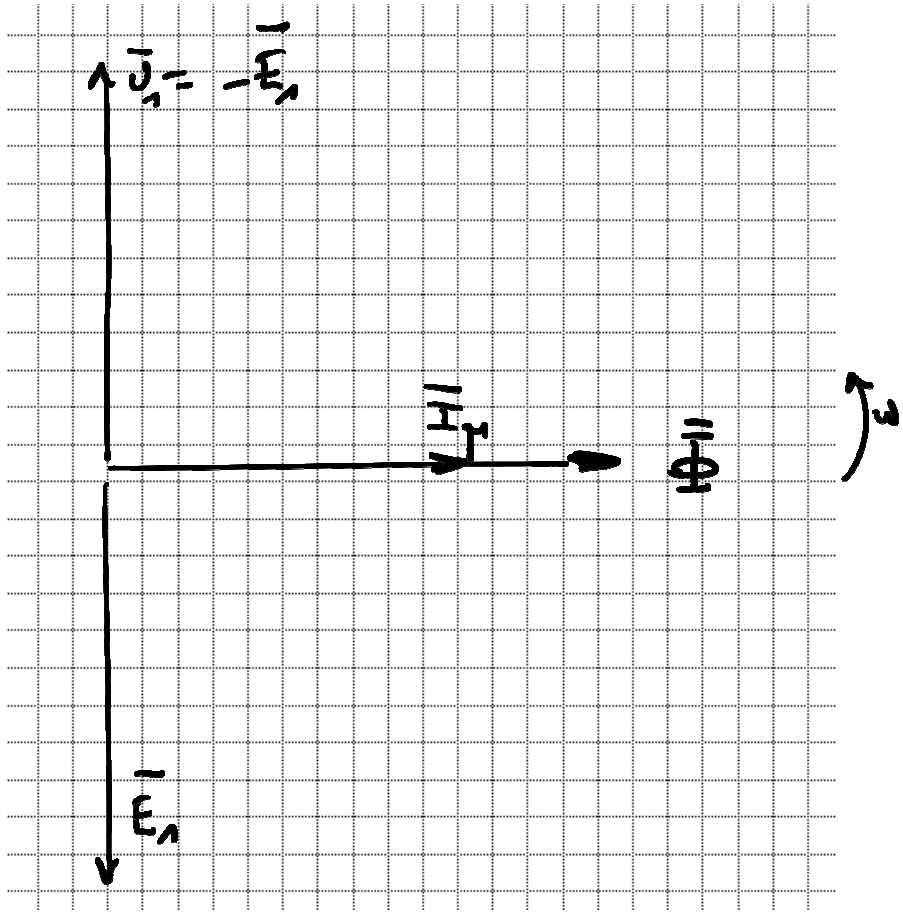
Stator

① $\bar{U}_1$

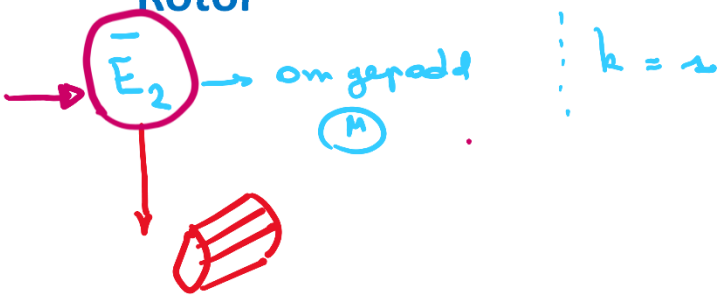
② $\bar{\Phi}$

③ $\bar{H}_r$

④ $\bar{E}_1 = -\bar{U}_1$



2.5.2. VD Rotor



$\bar{I}_2$ in fase met $\bar{E}_2$

$\downarrow$

$\bar{\Phi}_2$ Hopkinson in fase $\bar{I}_2$

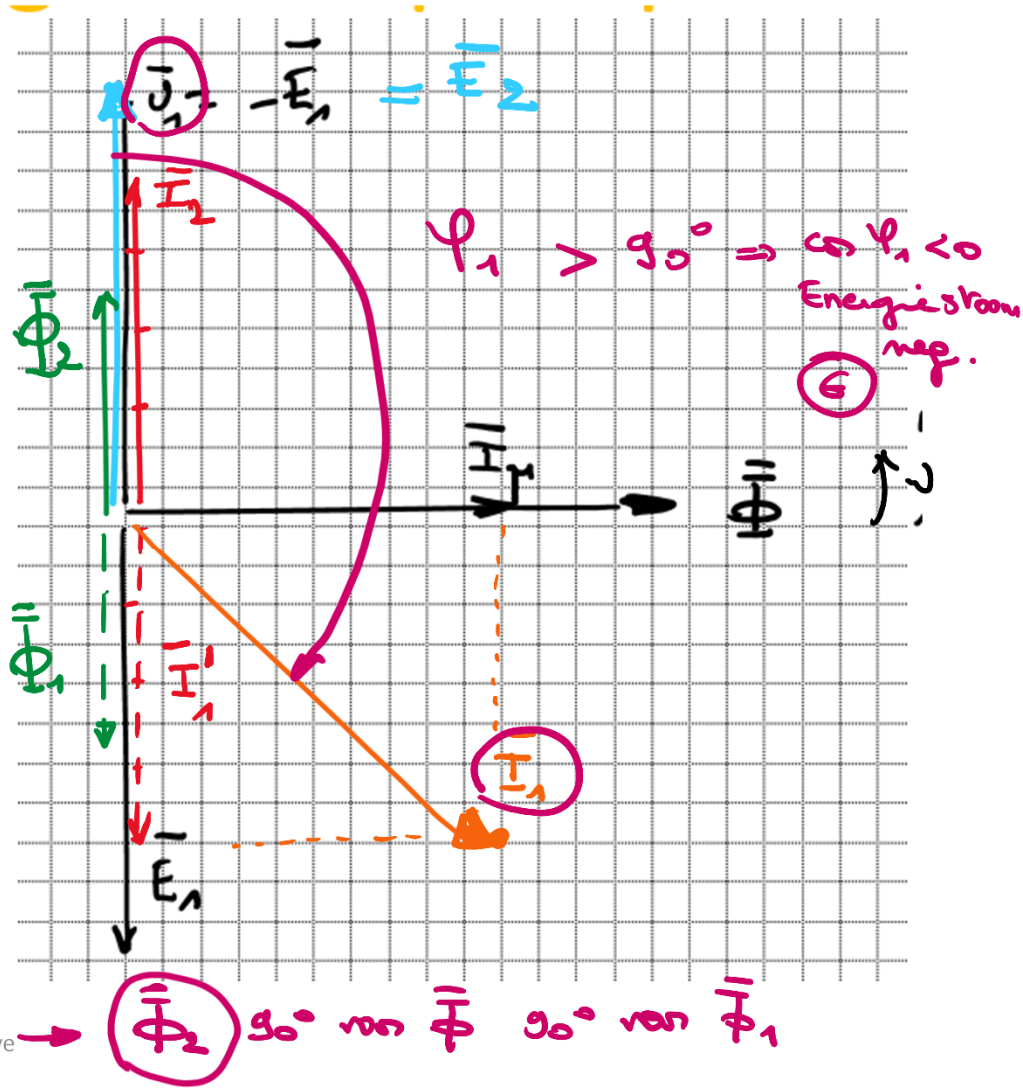
$\downarrow$

$\bar{\Phi}_1 = -\bar{\Phi}_2$

$\downarrow$

$\bar{I}_1'$ in fase $\bar{\Phi}_1$ $k = 1$!!

$\rightarrow$ $\boxed{\bar{I}_1 = \bar{I}_\mu + \bar{I}_1'}$



2.6 De slip

2.6.0. Inleiding

MOTORW

① STATOR ⟶ $X_1 = \omega_s \cdot L_2$; $E_1 = 4{,}44\ N_s\ f_s\ \Phi$ } $f_s = 50\,Hz$

② ROTOR

2.1 $n_r = 0 \leftarrow I_2 = 0 \leftarrow E_2 ! \neq 0$ (MAX) ; $\frac{E_1}{E_{2\,ST}} = \frac{N_1}{N_2} = k$ MAX

2.2 $n_r = 0 \leftarrow I_2 \neq 0 \leftarrow E_2 \neq 0$

BLOKKEREN $\Rightarrow n_r = 0$ { STARTEN / STILSTAAN

2.3 DRAAIEN !!

$n_r = 0$; n_{r_m} ; $n_{rel\,max}$; n_{rel} ↓↓ } → E_2 ↓↓

2.6 De slip

2.6.0. Inleiding

① ω_s

ω_r VARIABEL → V.D ?

② OEF Reflecteren

③ ROTOR Z_2 afh. n_r

STATOR

ROTOR

GROOTH $\neq \omega$

ω_s

➡ **Frequentie afhankelijke grootheden !!**

E X ⋯⋯ ➤ ω_s

Bijkomende info

Relatieve snelheid