Gelijkstroommachines

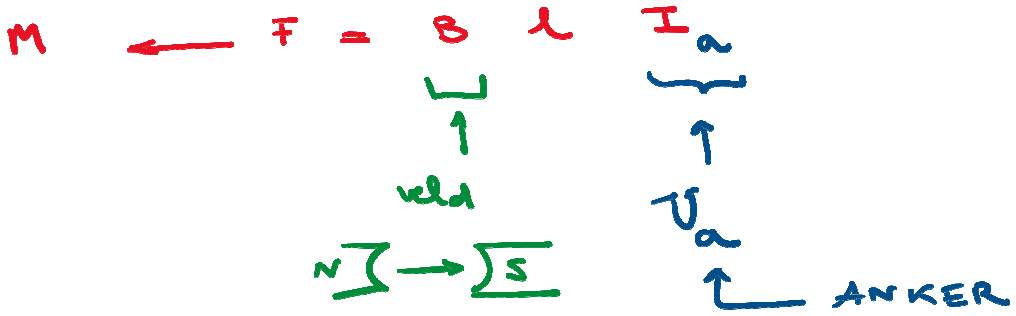
L. Butaye – academiejaar 2024-2025

1.1 Overzicht

- *Opbouw DC-machine*
- *Werkingsprincipe motor en dynamo*
- *Bekrachtigingswijze (OB-PM-shunt-serie-motor)*
- *Karakteristieken*
- *Ankerreactie*
- *Toerentalregeling*
- *Aanloopstroombeperking*
- *Vermogen en rendement*
- *Remmen*

1.2 De bouw van de gelijkstroom machine

1.2.0. Inleiding



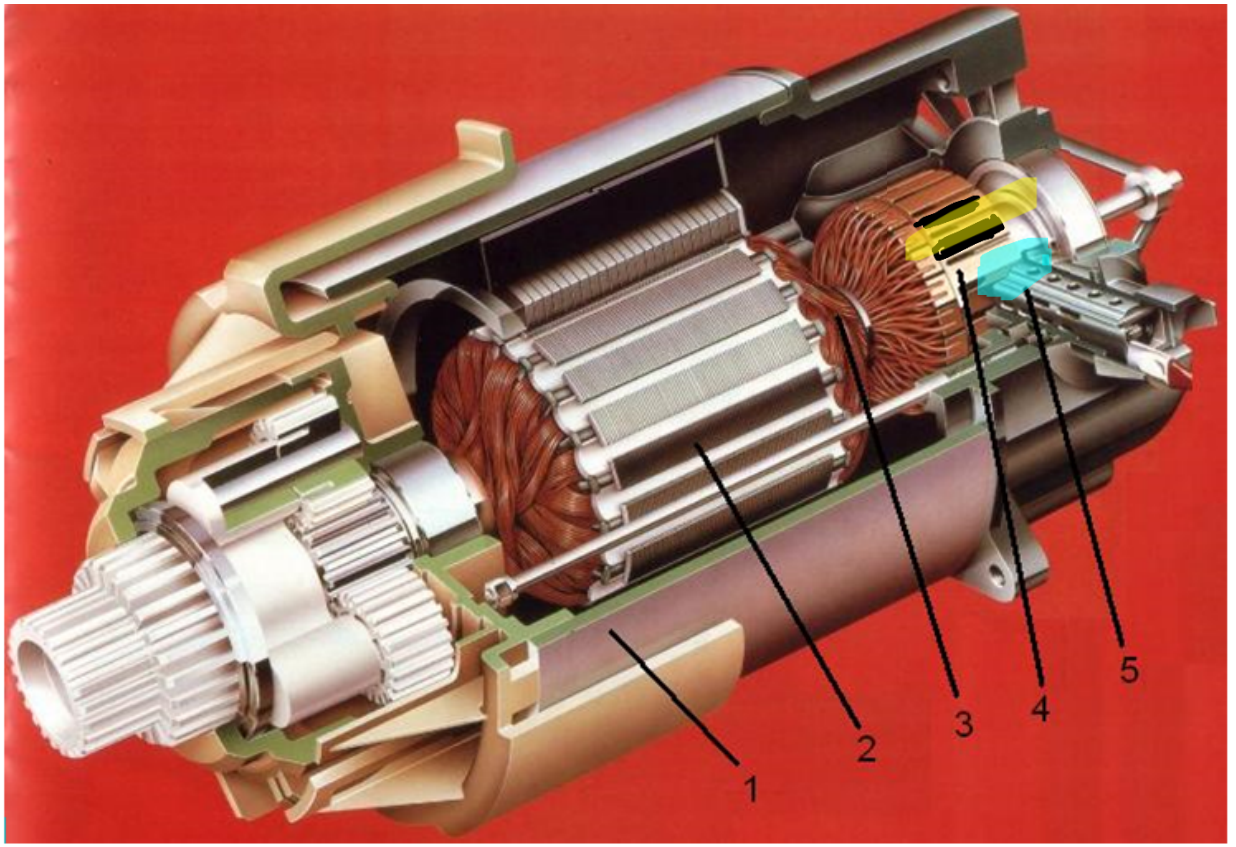
Transformatoren	ASM	DC-machine
Smoorspoel	Draaiveld	NI ⇒ S
Prim	STATOR	Stator
/	luchtspleet	luchtspleet
SEC	ROTOR	Anker

VELD →

1.2 De bouw van de gelijkstroom machine

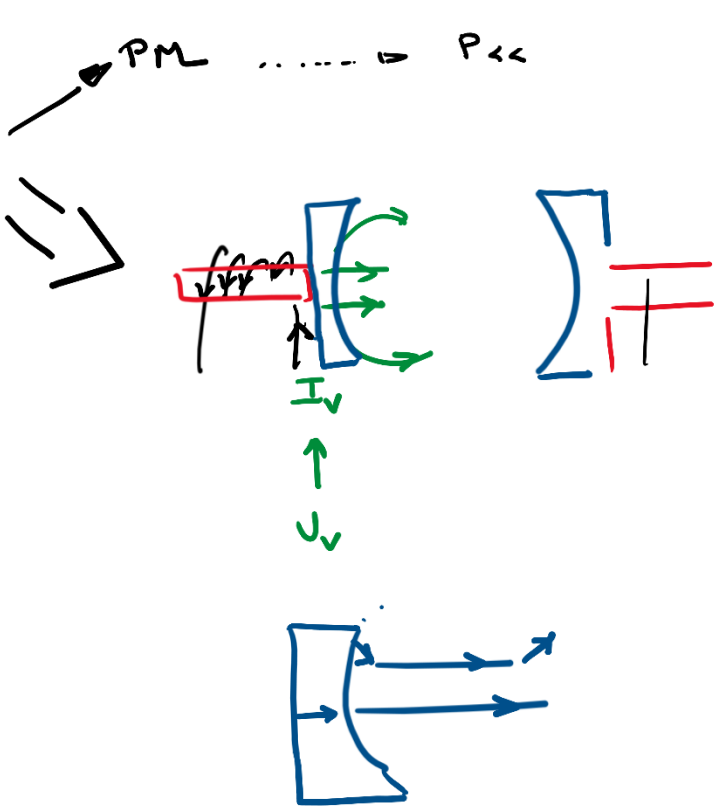
1.2.1. Onderdelen

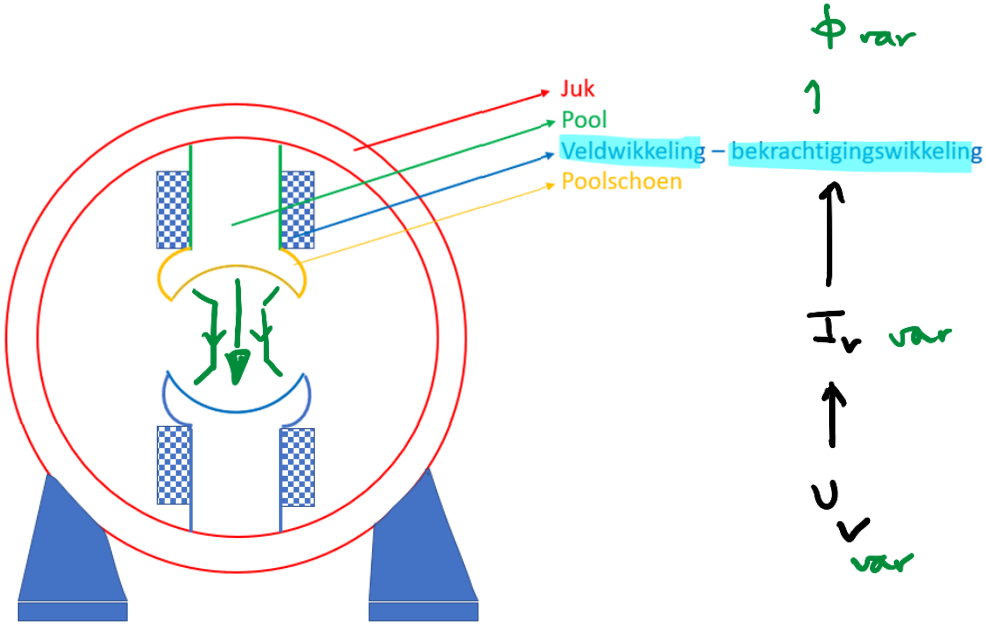
1. De stator - behuizing
2. De statorwikkeling
3. De ankerwikkeling
4. De collector/commutator
5. De koolstofborstels



1.2 De bouw van de gelijkstroom machine

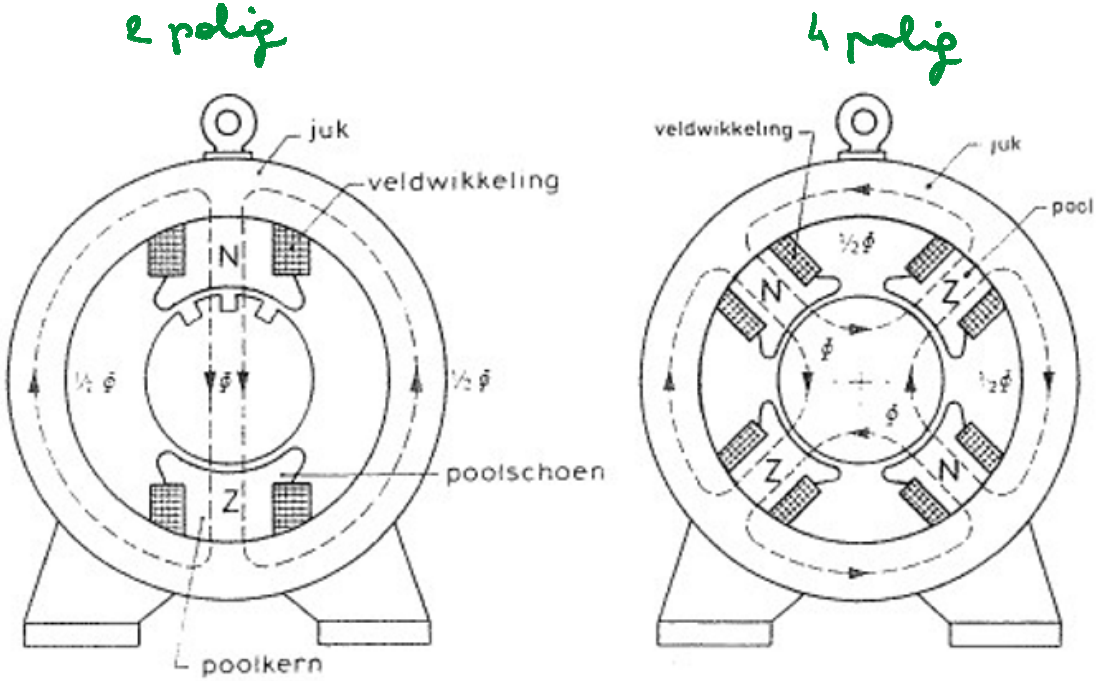
1.2.2. De stator





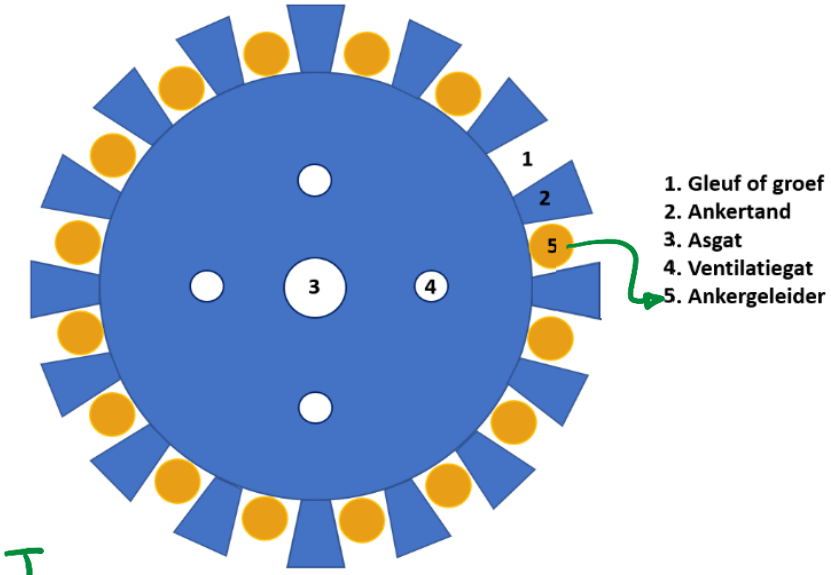
1.2 De bouw van de gelijkstroom machine

1.2.2. De stator



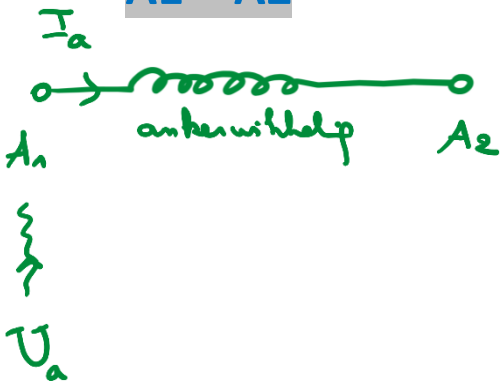
1.2 De bouw van de gelijkstroom machine

1.2.3. Het anker



1. Gleuf of groef
2. Ankertand
3. Asgat
4. Ventilatiegat
5. Ankergeleider

A1 – A2



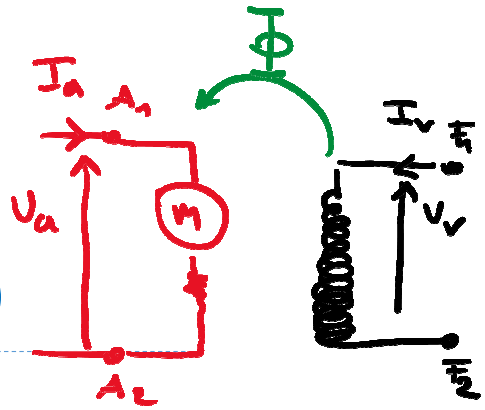
$M \Leftarrow F = B\,l\,I_a$

I_v « >>

1.3 Types gelijkstroom machines

1.3.1. Permanent magneet motor (PM-motor)

1.3.2. Types bekrachtiging



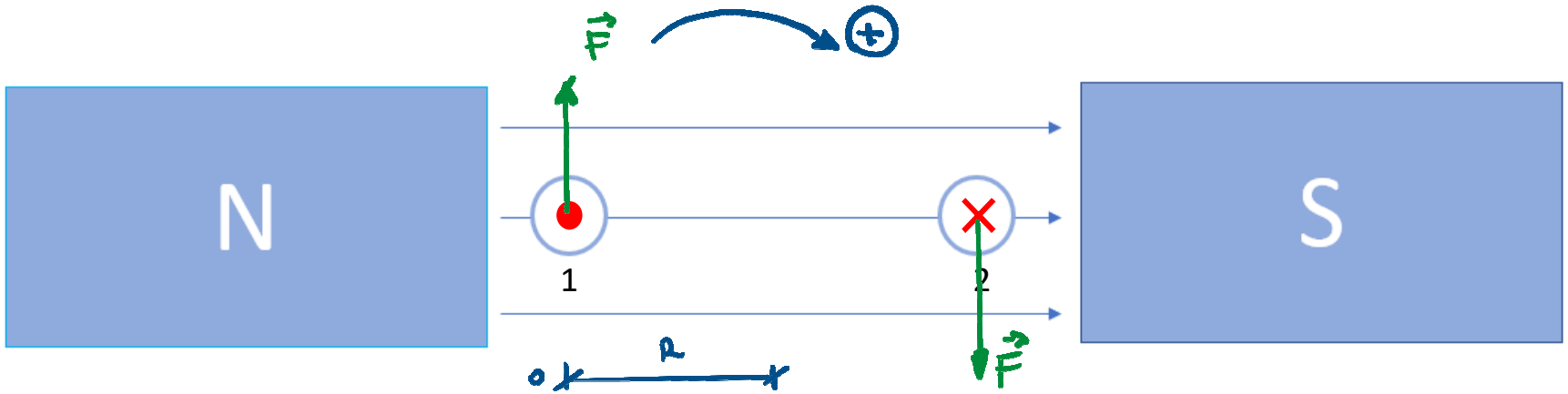
- Onafhankelijk bekrachtigde gelijkstroommotor (OB-motor)

- Serie motor
  - *Bekrachtigingswikkeling in serie met de ankerwikkeling*
- Shuntmotor
  - *Bekrachtigingswikkeling in parallel met de ankerwikkeling*
- Compoundmotor
  - *Bekrachtigingswikkeling deels in serie, deels in parallel met de ankerwikkeling*

1.3 Types gelijkstroom machines

	Benaming	Klemaanduiding
Anker	ankerwikkeling	A1 – A2
Ankerreactie	hulppoolwikkeling	B1 – B2
	compensatiewikkeling	C1 – C2
Veld - Bekrachtiging	seriewikkeling	D1 – D2
	shuntwikkeling	E1 – E2
	onafhankelijke bekrachtiging	F1 – F2

1.4 Principe gelijkstroom motor



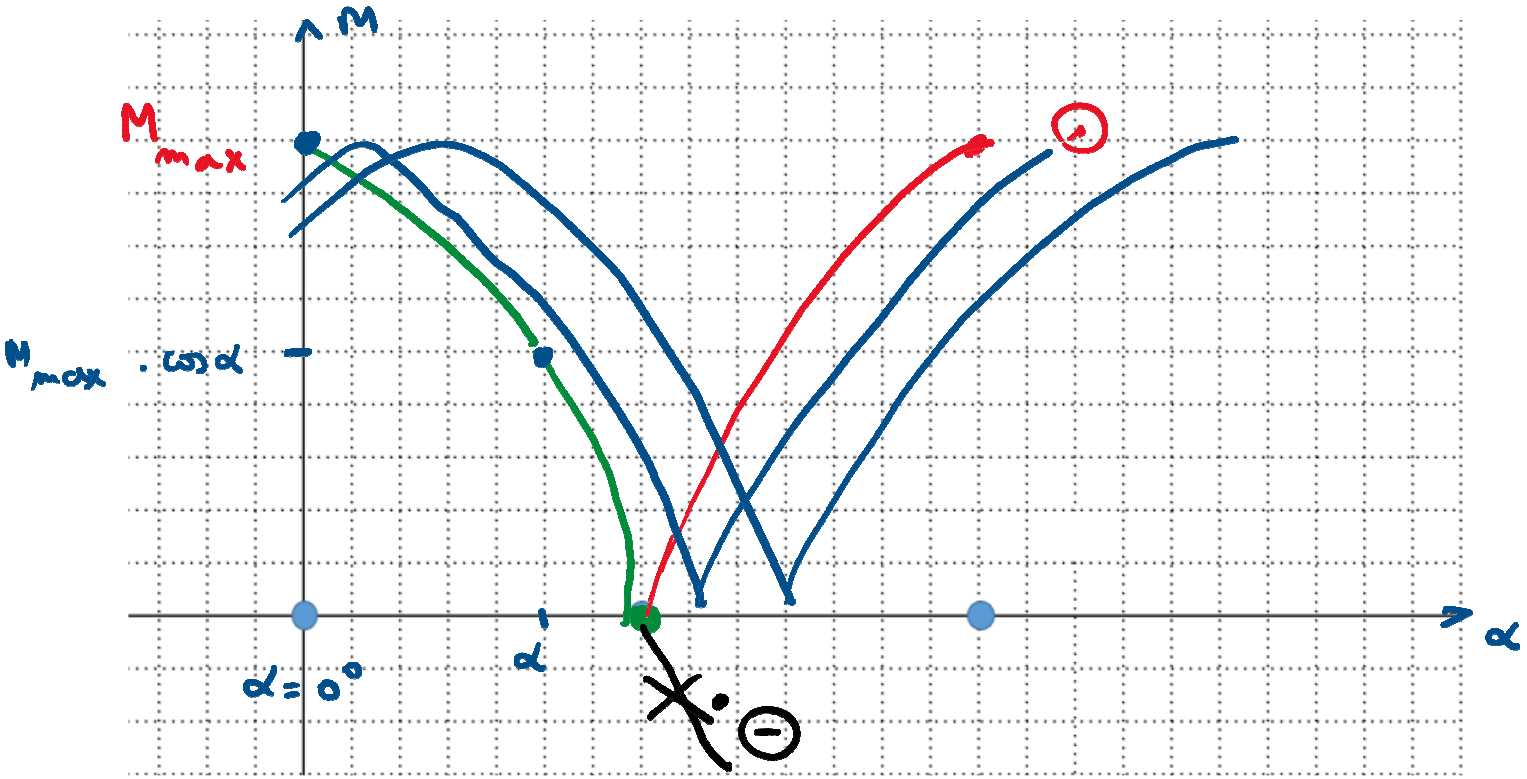
LHR

$\alpha = 0°$ $= (\vec{B}, \overrightarrow{st.z})$ Fig.1

$F = B\,l\,I_a$

$M = F \cdot 2R = B \cdot l \cdot I_a \cdot 2R = M_{max}$

1.4 Principe gelijkstroom motor



1.4 Principe gelijkstroom motor

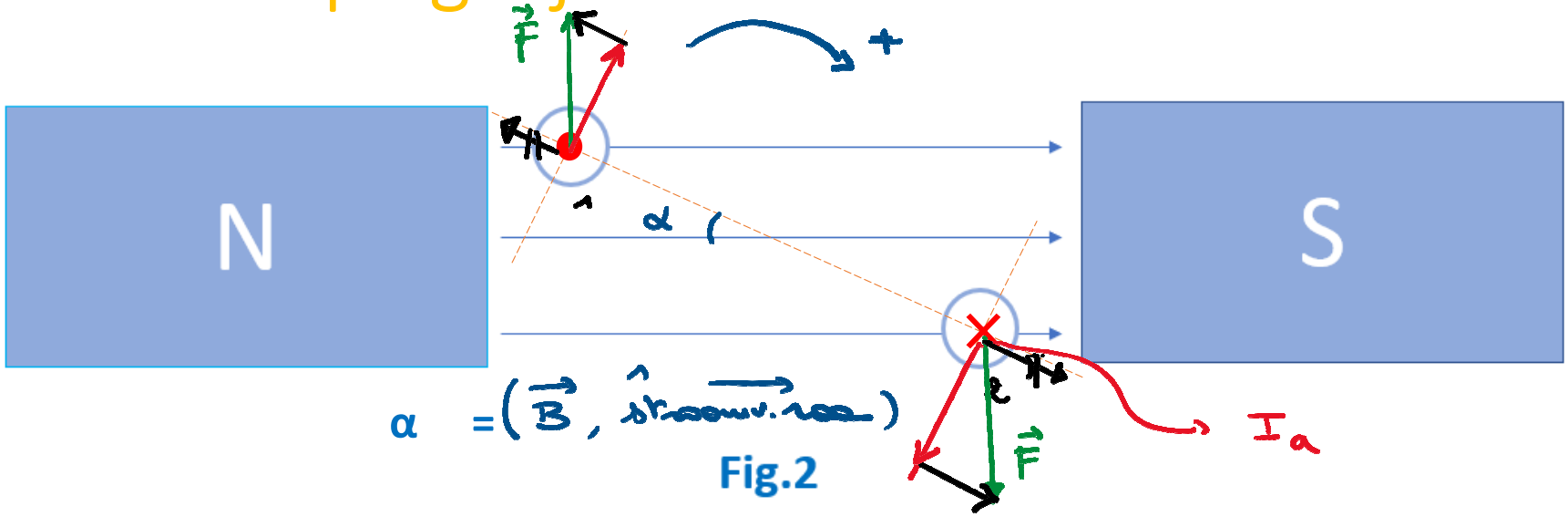


Fig.2

$$F = F \cdot \cos\alpha$$

$$M = \overline{B\,l\,I_a} \cdot 2R \cdot \cos\alpha = M_{max} \cdot \cos\alpha$$

1.4 Principe gelijkstroom motor

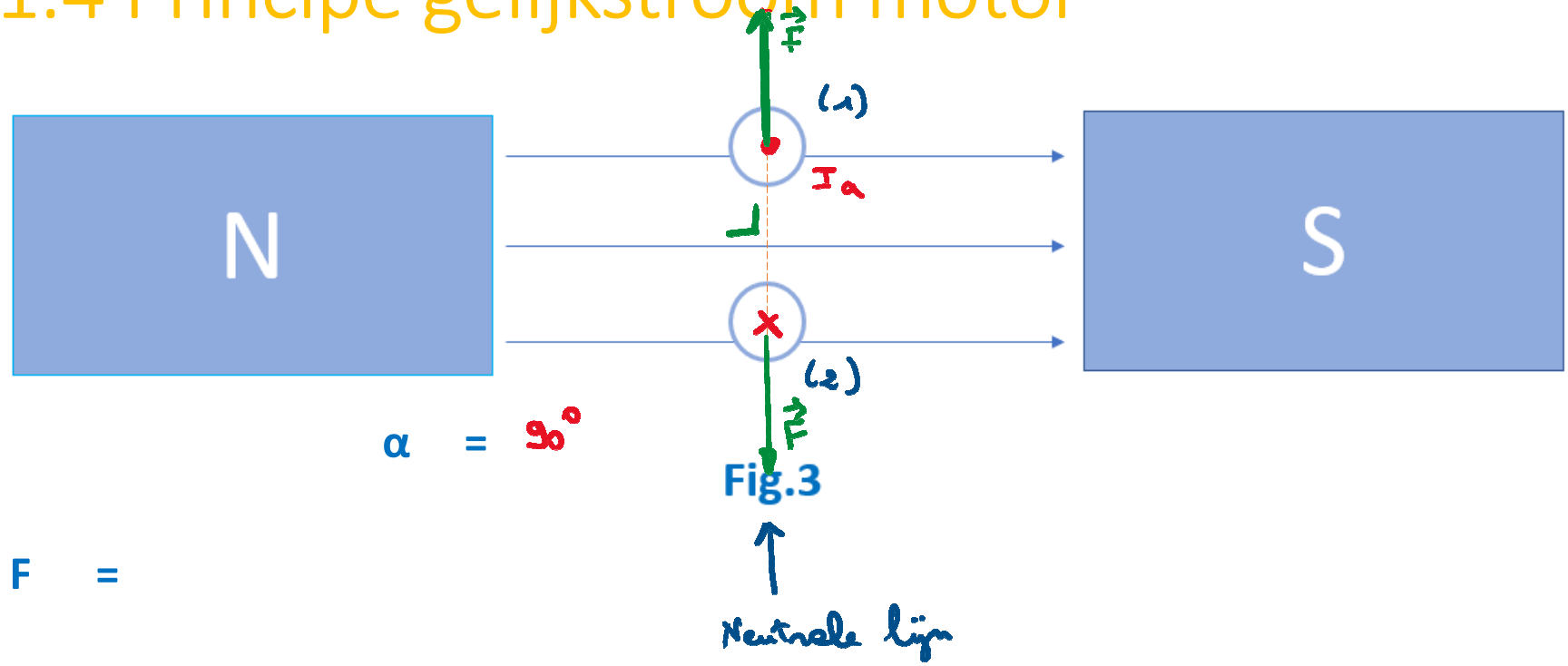


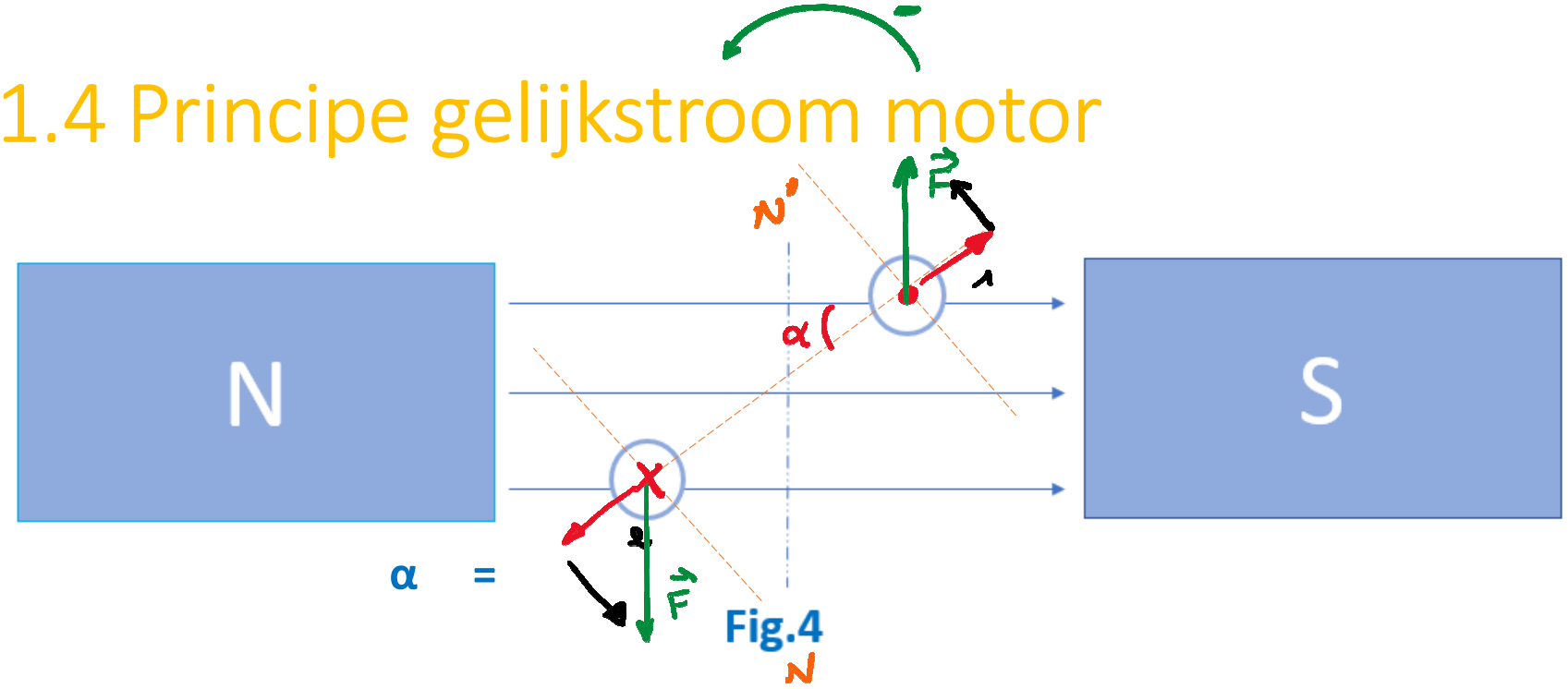
Fig.3

Neutrale lijn

? F =

M = 0

1.4 Principe gelijkstroom motor



α =

Fig.4

F =

M = negatief → OPL

STROOMZIN OMPOLEN NN'

• 1 → x 1

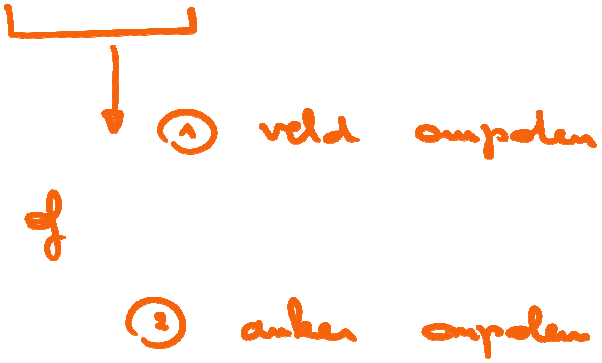
x 2 → • 2

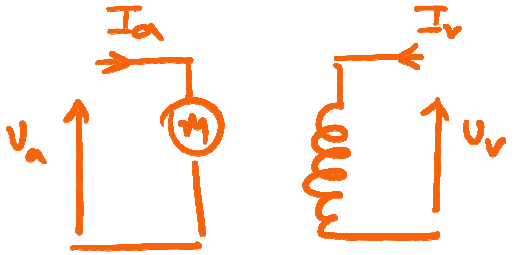
1.4 Principe gelijkstroom motor

1.4.1. Draaizin motor constant

1.4 Principe gelijkstroom motor

1.4.2. Draaizin motor omkeren

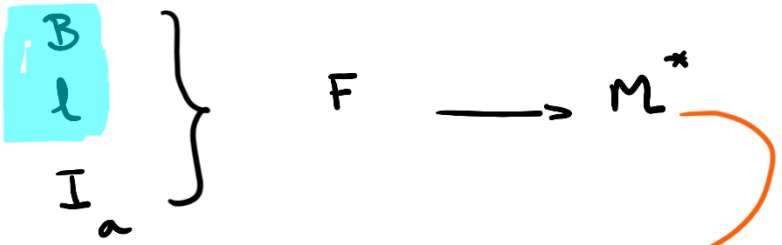




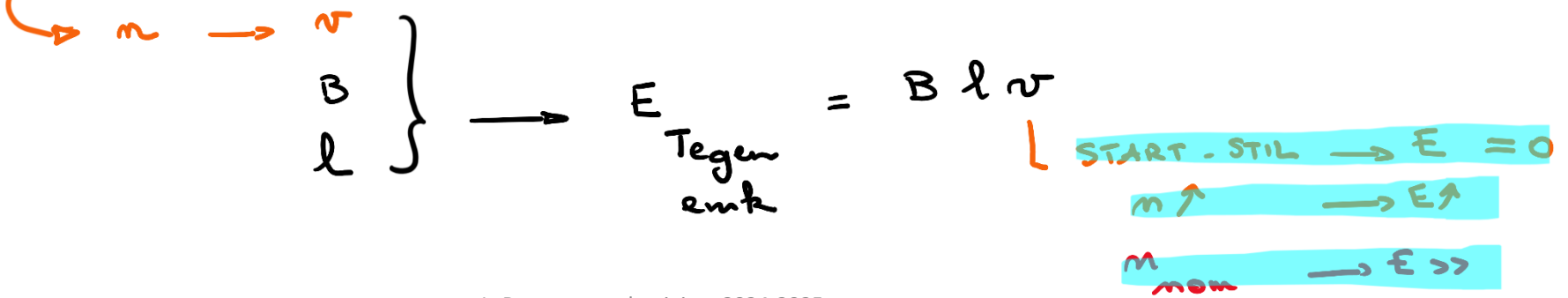
SERIEMOTOR ??

1.4 Principe gelijkstroom motor

1.4.3. Primair verschijnsel

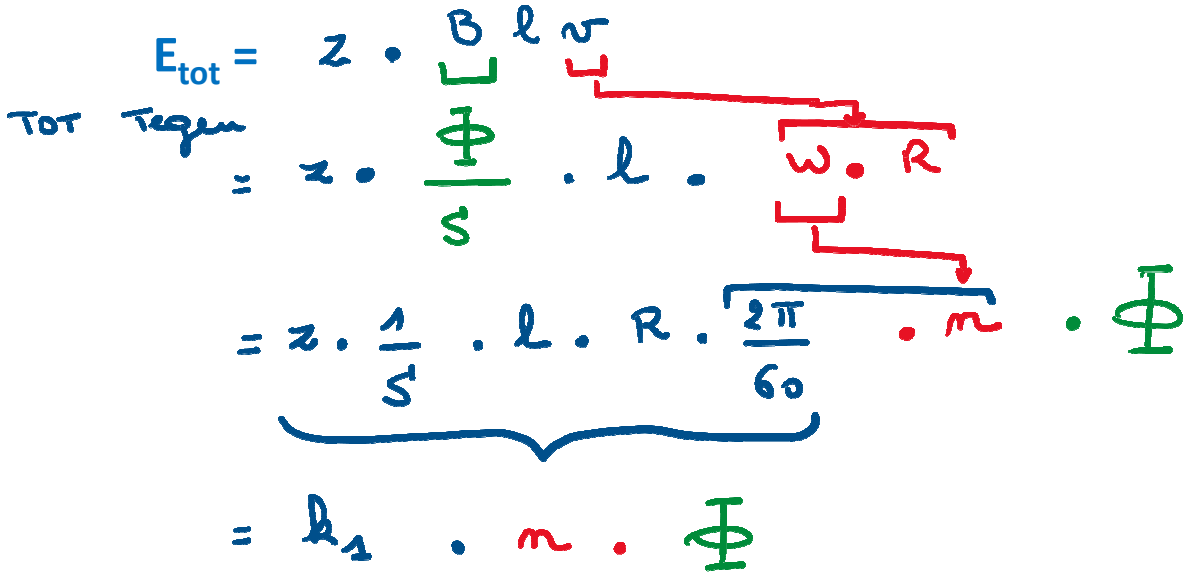


1.4.4. Secundair verschijnsel



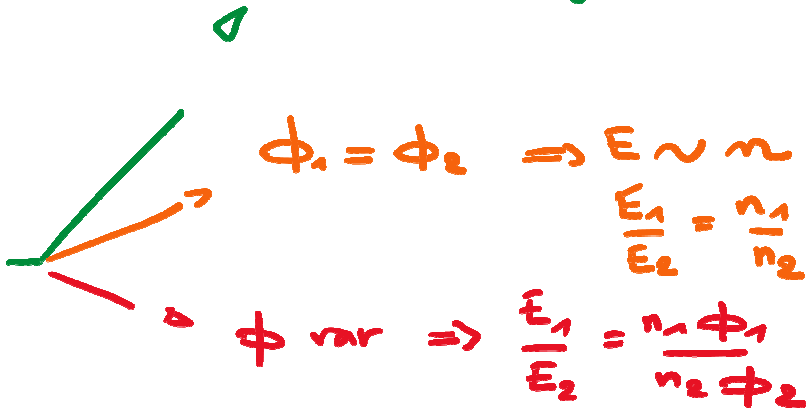
1.4 Principe gelijkstroom motor

1.4.5. Tegenemk



$E_{tot} = k_1 \cdot n \cdot \phi$

k_1 = machineconstante
n = toerental
ϕ = flux (Wb)



1.4 Principe gelijkstroom motor

1.4.6. Equivalent schema

n ? ← $E_{tot} = k_1 . n . \Phi$

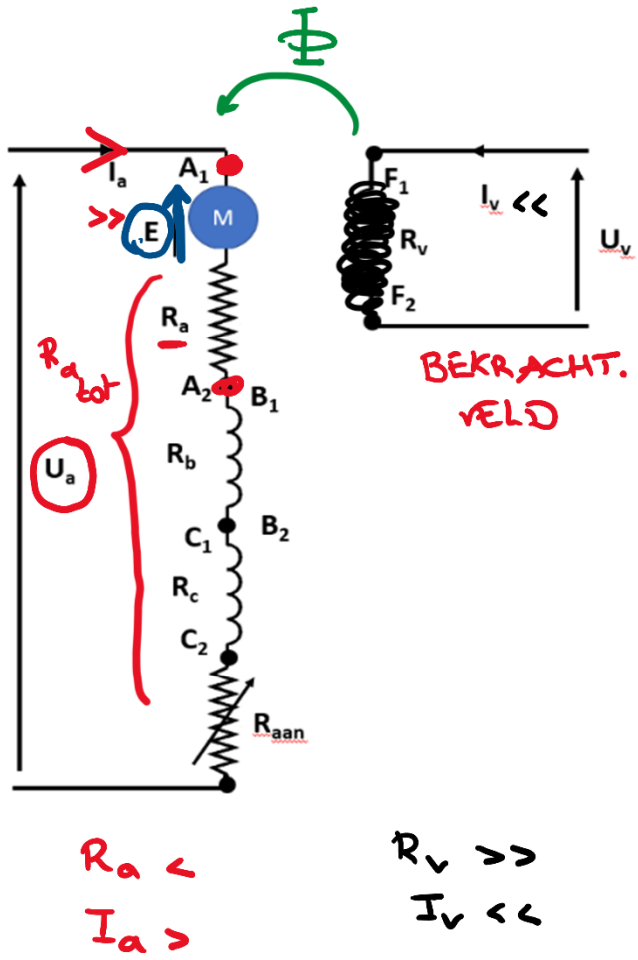
k_1 = machineconstante
n = toerental
Φ = flux (Wb)

$U_a = E + R_{a\,tot} . I_a$

$U_a = k_1 n \Phi + R_{a\,tot} . I_a$

$E = U_a - R_{a\,tot} . I_a$

$n = \frac{U_a - R_{a\,tot} . I_a}{k_1 \Phi}$



1.4 Principe gelijkstroom motor

1.4.7. Tegenemk

n = 0 ⟶ $E = 0$ ⟶ U_a ↷ R_{atot}

n stijgt ⟶ $E = k \cdot m \cdot \phi$ (↑ ← ↑)

$R_{atot} \cdot I_a$ ↓

I_a ↓

n_n ⟶ E groot ⟶ I_a ↓

$E \lesssim U_a$