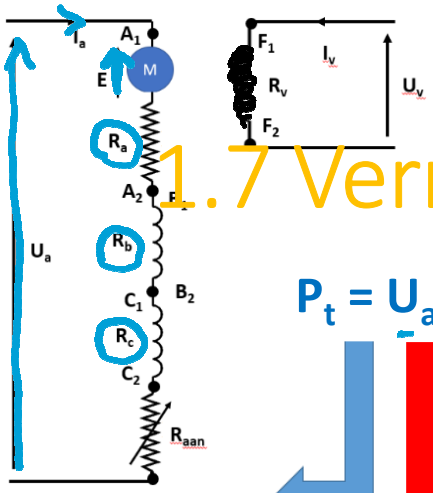
1.7 Vermogenverdeling motor



$P_t = U_a \cdot I_a$

100 %

$P_{Cu} = R_{a,tot} \cdot I_a^2$

$R_a + R_b + R_c$

Serieschakeling R_v

$P_i = U_a I_a - R_{a\,tot} \cdot I_a^2$

$= I_a (U_a - R_{a\,tot} \cdot I_a)$

$= E \cdot I_a$

$P_v = P_{Fe} = (P_h + P_{ws})$ + $P_{wrijv} + P_{vent.}$

$P_n = P_{as} = P_{mech} = P_i - P_v$

$= P_{kenplaat}$

$\eta = \frac{P_n}{U_a \cdot I_a} \cdot 100\%$

$P = M \cdot \omega$

$M_i = \frac{P_i}{\omega}$

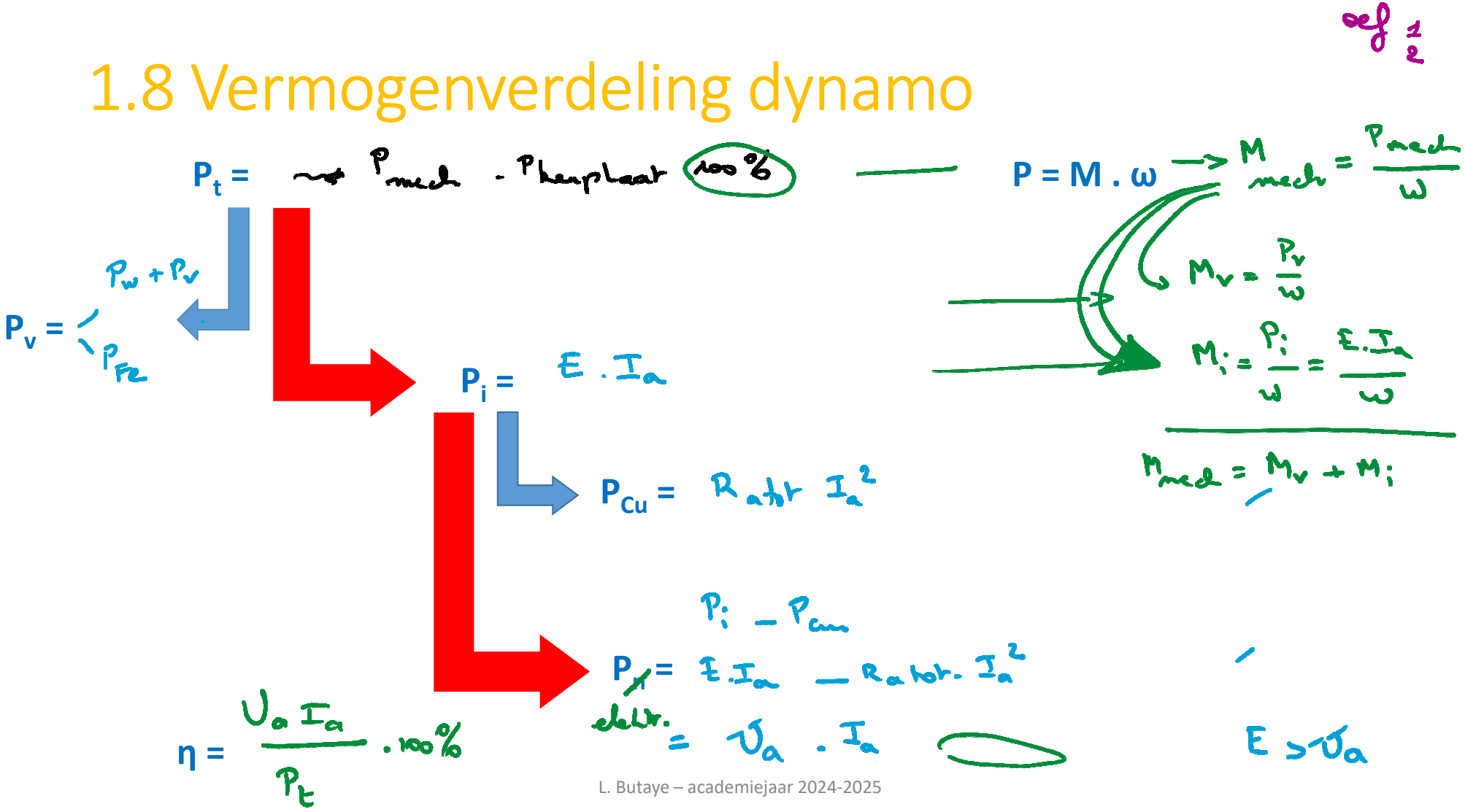
$M_v = \frac{P_v}{\omega}$

$M_n = \frac{P_n}{\omega}$

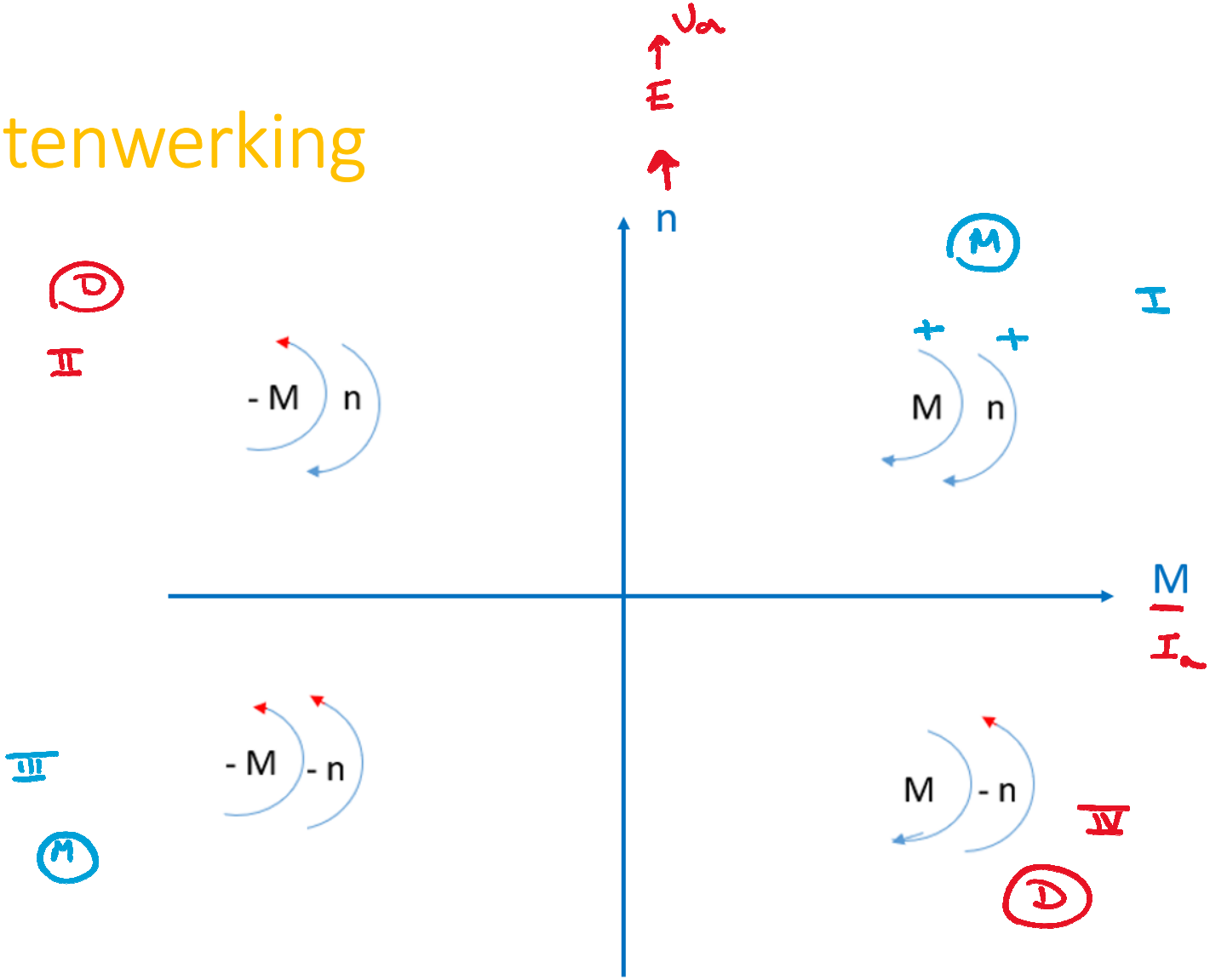
$M_i = M_v + M_n$

$E < U_a$

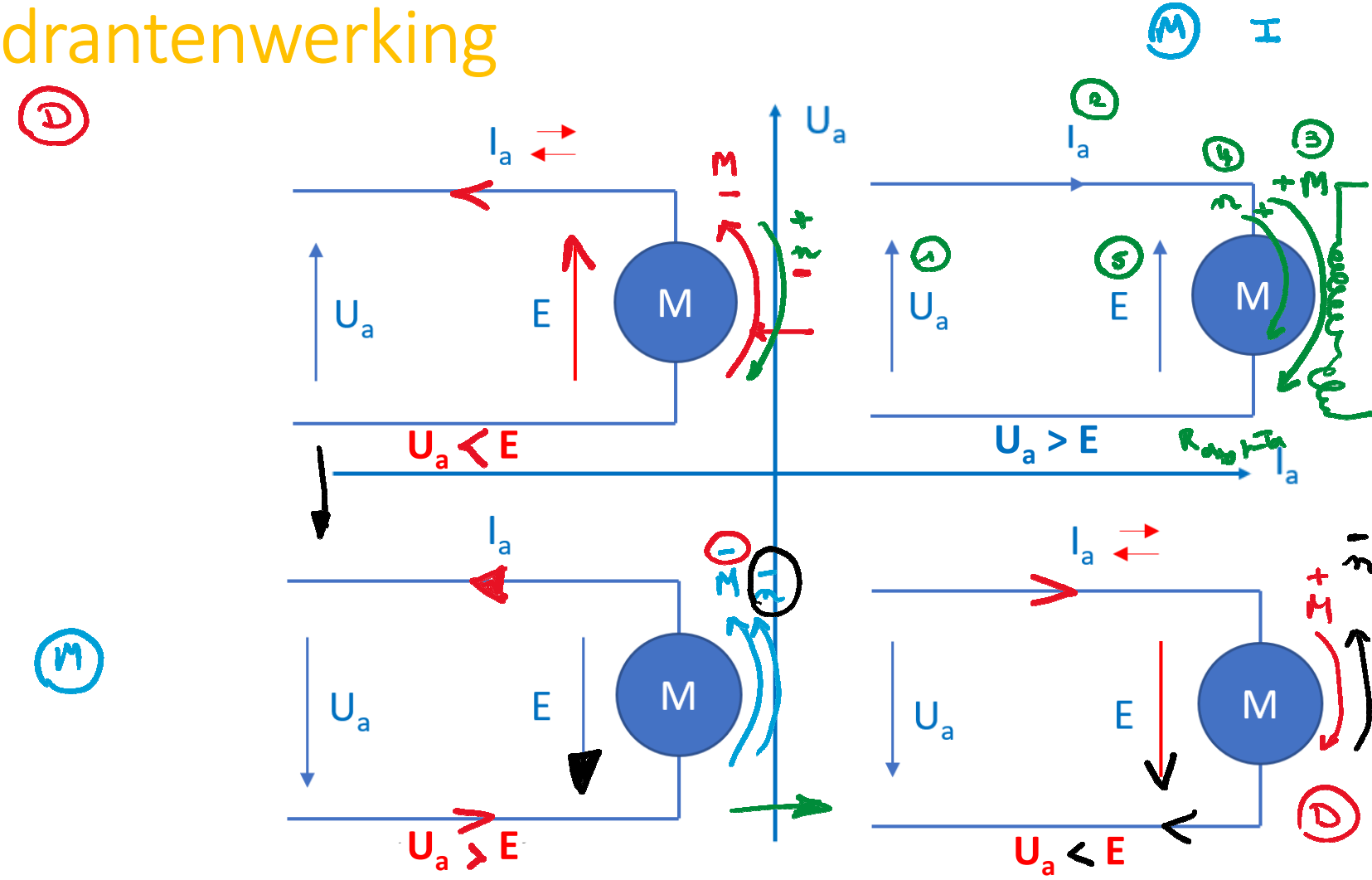
1.8 Vermogenverdeling dynamo



1.9 Kwadrantenwerking



1.9 Kwadrantenwerking



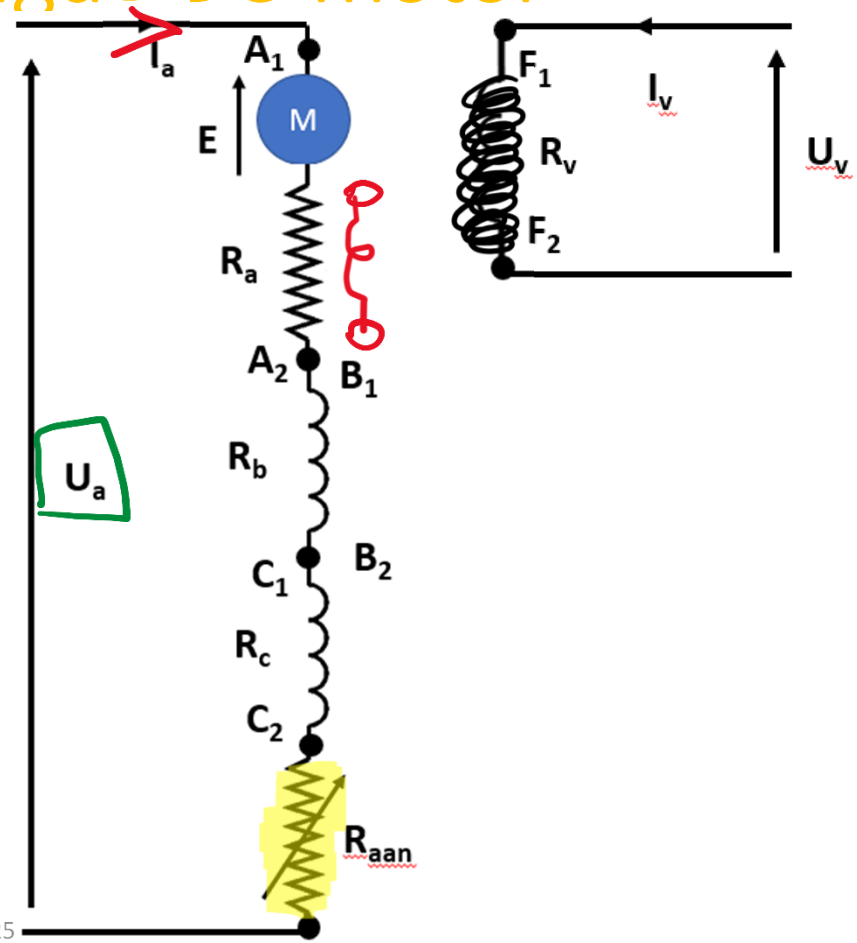
1.10 Onafhankelijk bekrachtigde DC-motor

1.10.1. EQ.S.

{ VELD
  BEKRACHTIGING } → Φ_{max} (non)

ANKER $R_a + R_b + R_c = R_{ator}$

START ?? → $n = 0$ → $E = 0$ → $I_{aan} = \frac{U_{a-0}}{R_{ator}}$ ($I_{aan} >>$, $R_{ator} <<$)



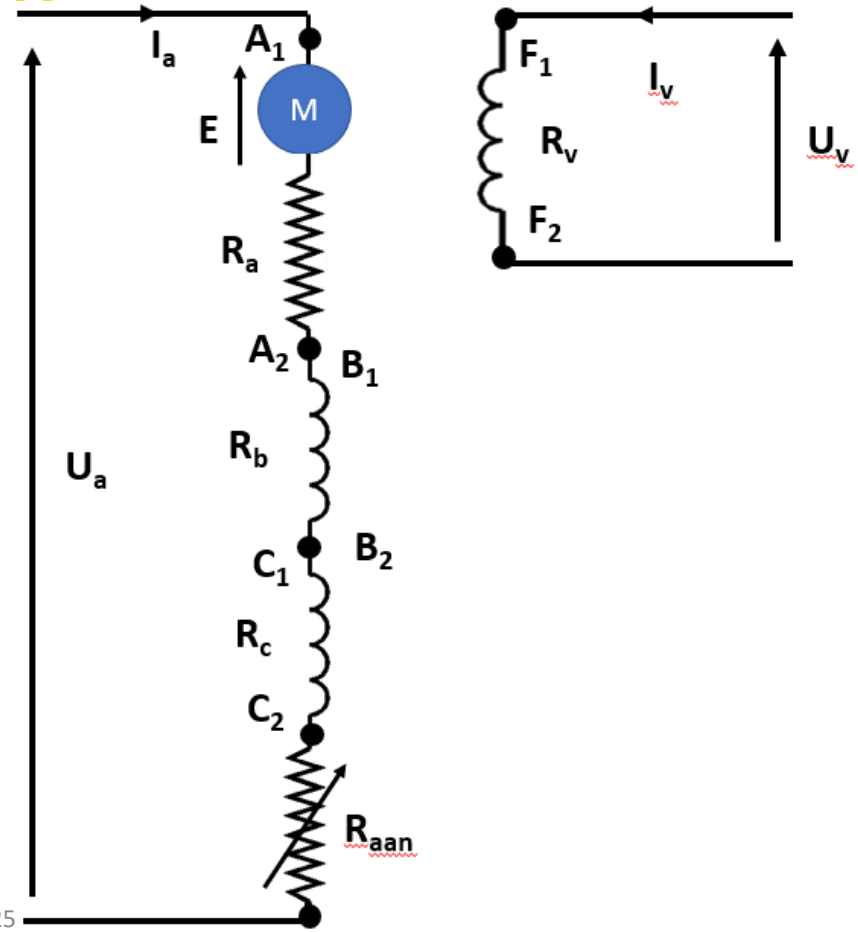
1.10 Onafhankelijk bekrachtigde DC-motor

1.10.1. EQ.S.

Starten

n) ↑ • $\tau_a < \tau_{weld}$ ← $\Phi_v > \Phi_a$

• $I_a > I_v$



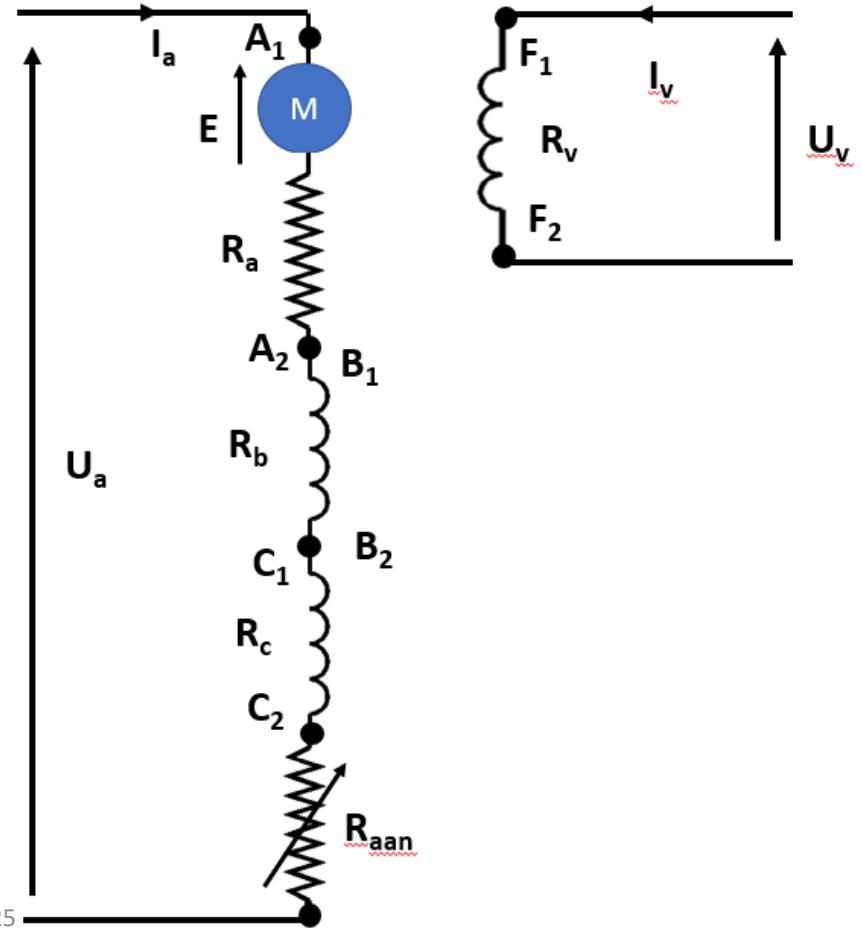
1.10 Onafhankelijk bekrachtigde DC-motor

1.10.2. Veldstroom

$$I_v = \frac{U_v}{R_v}$$

1.10.3. Ankerstroom

$$I_a = \frac{U_a - E}{R_{ator}}$$



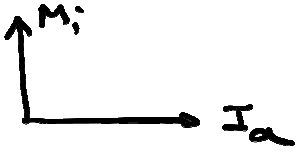
1.10 Onafhankelijk bekrachtigde DC-motor

1.10.4. Koppel $M_i = f(I_a)$

$M_i = k_2 \cdot \Phi \cdot I_a$

k_2 = constante

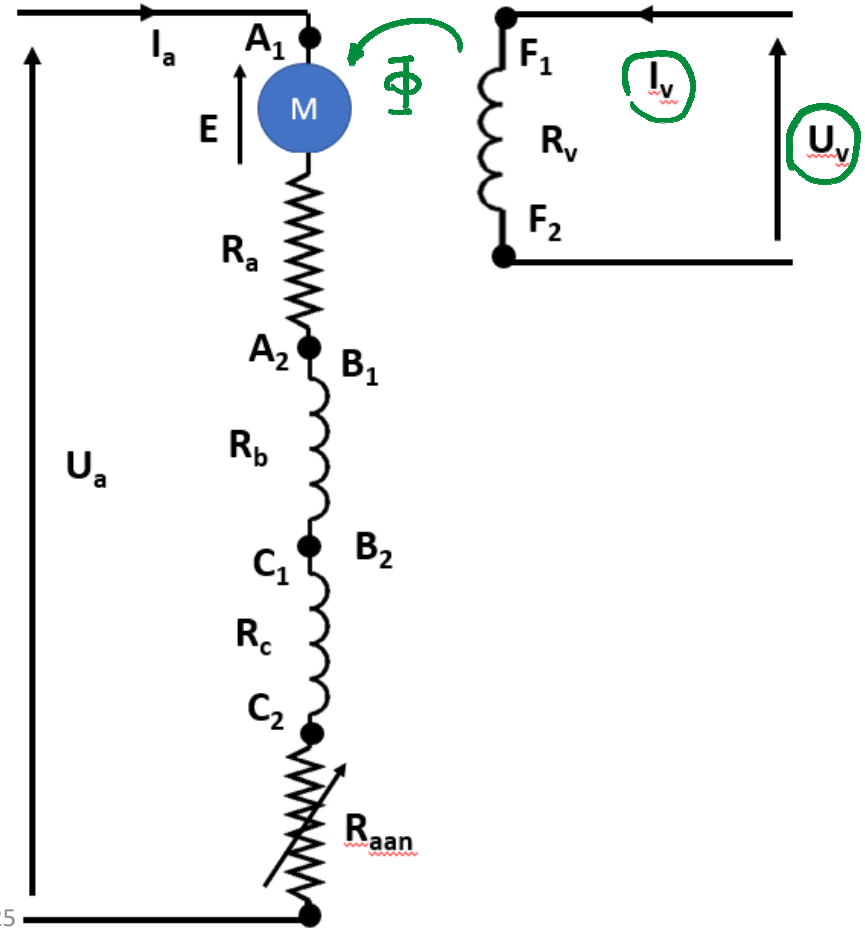
Φ = constante



$M_i \sim I_a \longrightarrow$ RECHTE

(0, 0)

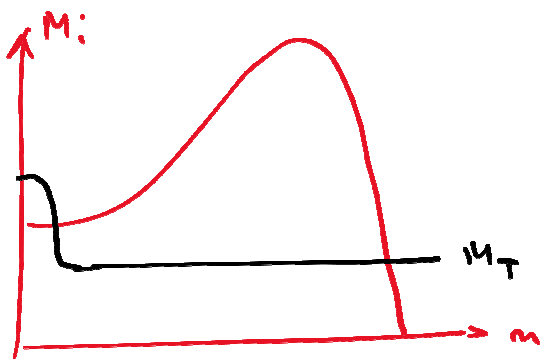
$I_a = 0 \rightarrow \Phi = 0 \rightarrow M_i = 0$



1.10 Onafhankelijk bekrachtigde DC-motor

1.10.4. Koppel $M_i = f(I_a)$

VGL ASM



LOSBREEKKOPPEL

DC

$M_i = k_2 \cdot I_a$

$1.5\ M_{im} \leftarrow 1.5\ I_{am}$

1.10 Onafhankelijk bekrachtigde DC-motor

1.10.4. Koppel $M_i = f(I_a)$

$\Phi = cte$!!

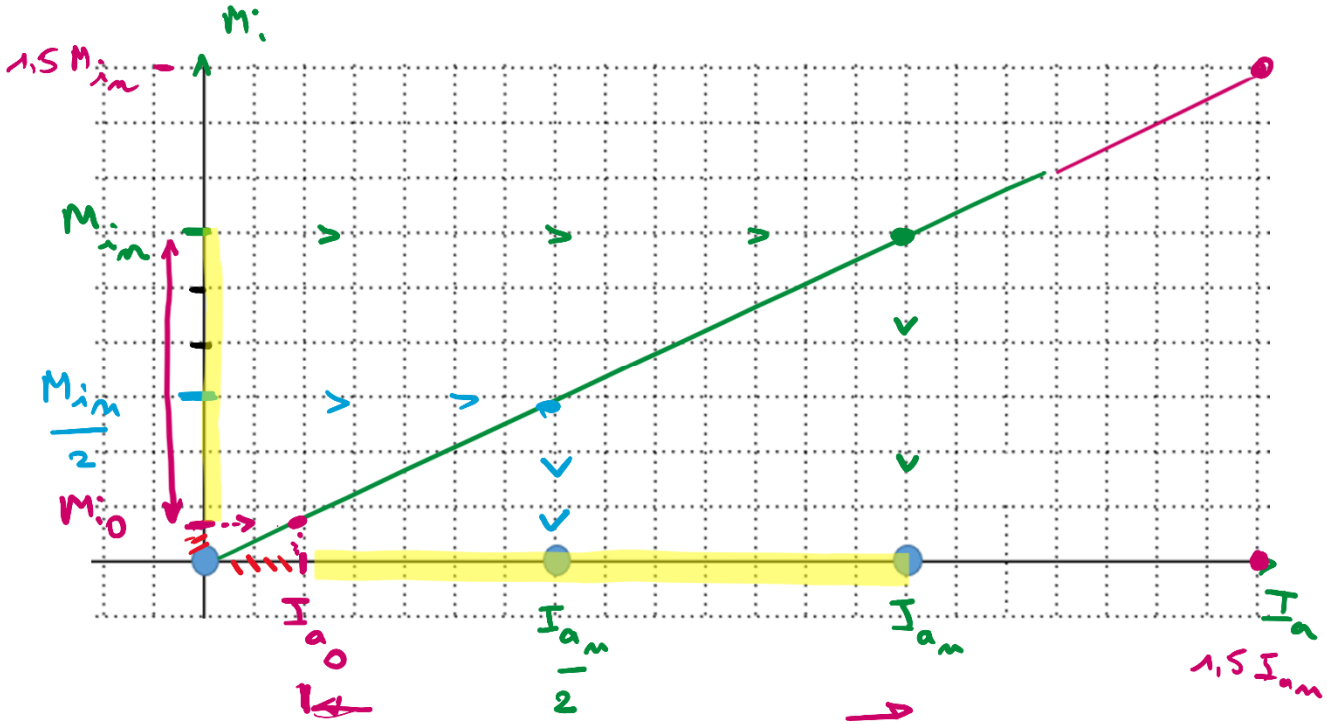
① $M_T = M_i$

nominaal → M_{im} → I_{am}

② M_T ↘ → I_a ↓

③ $M_T \sim \frac{M_{im}}{2}$

④ NULLAST



1.10 Onafhankelijk bekrachtigde DC-motor

1.10.5. Toerental n = f(I_a)

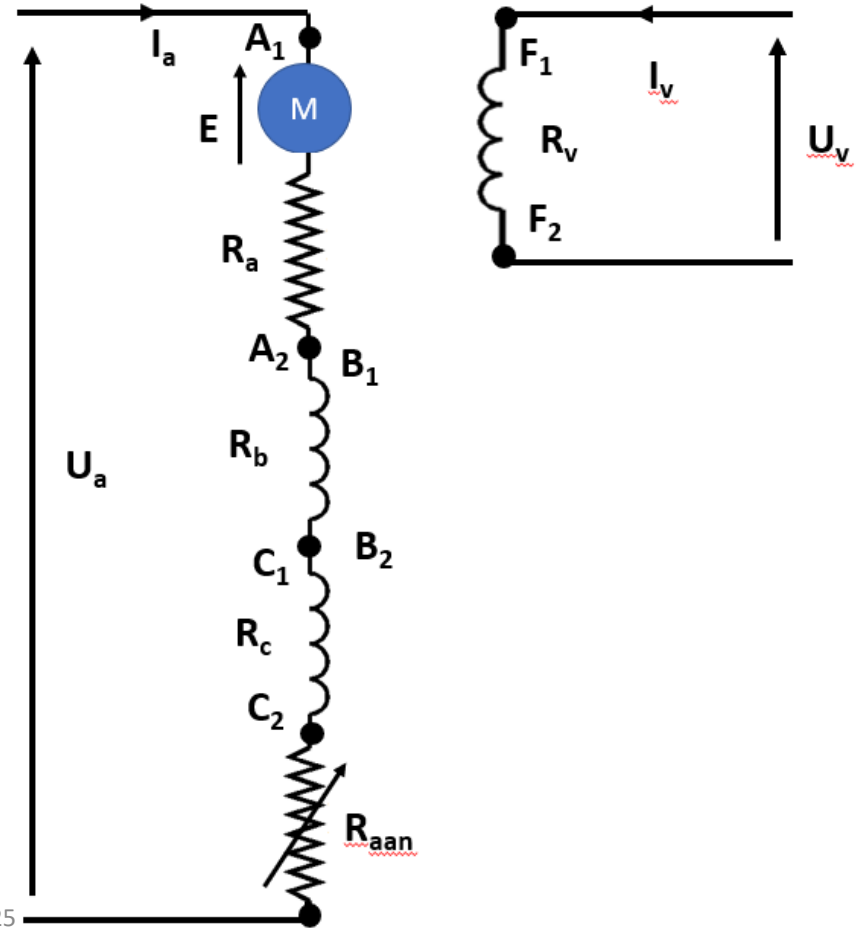
$\Phi = cte$

n ? ← $E = k_1 \cdot n \cdot \Phi$

$\Rightarrow n = \frac{E}{k_1 \cdot \Phi}$

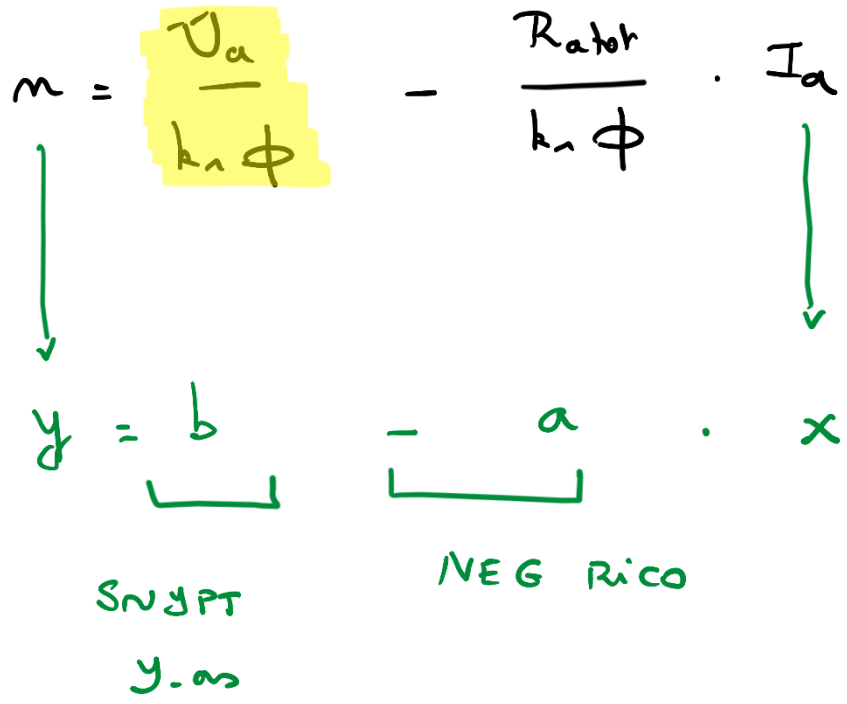
$= \frac{U_a - R_{atot} \cdot I_a}{k_1 \cdot \Phi}$

$\Rightarrow n = \frac{U_a}{k_1 \Phi} - \frac{R_{atot}}{k_1 \Phi} \cdot I_a$



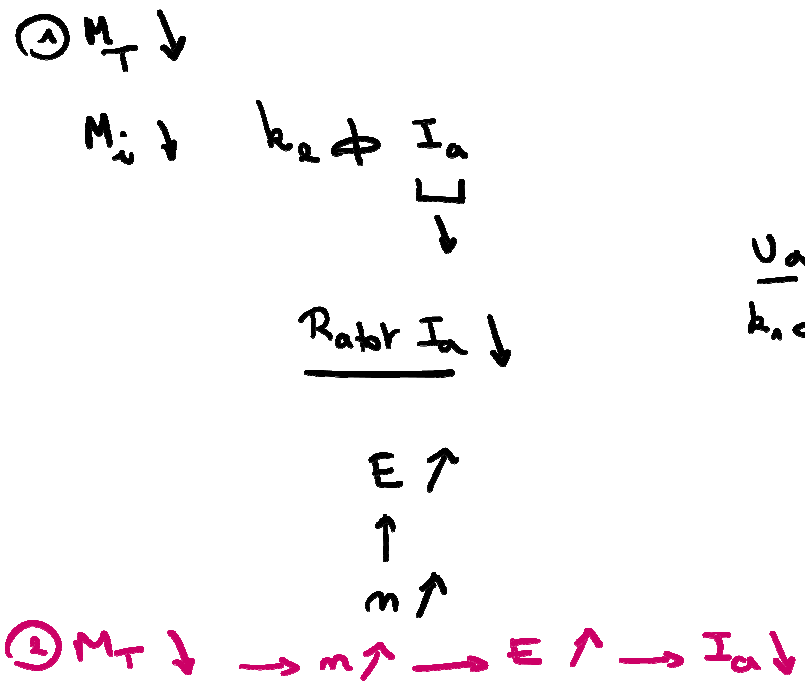
1.10 Onafhankelijk bekrachtigde DC-motor

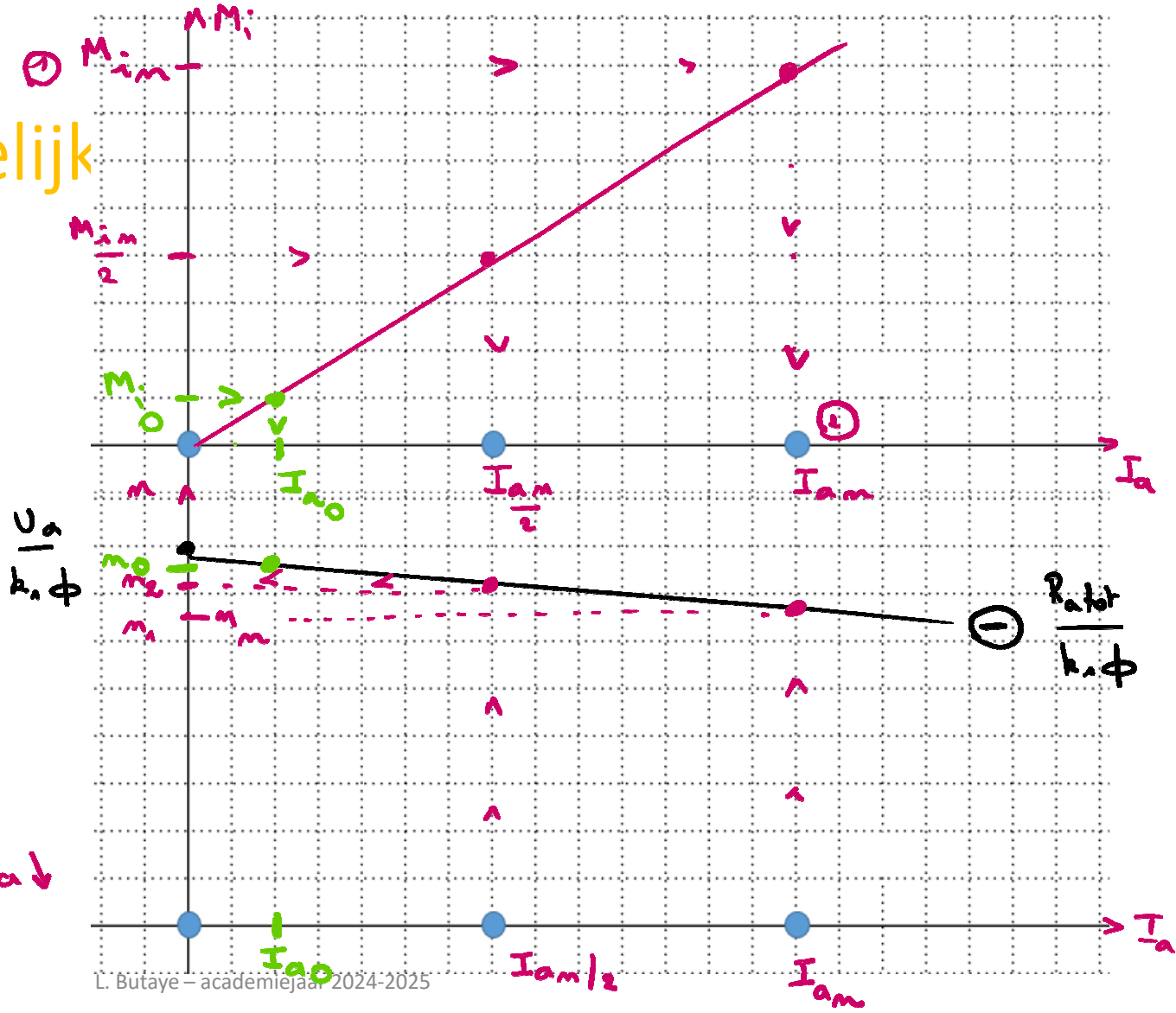
1.10.5. Toerental n = f(I_a)



1.10 Onafhankelijk

1.10.5. Toerental n = f(I_a)





1.10 OB-motor

1.10.6. Koppel n = f(M_i)

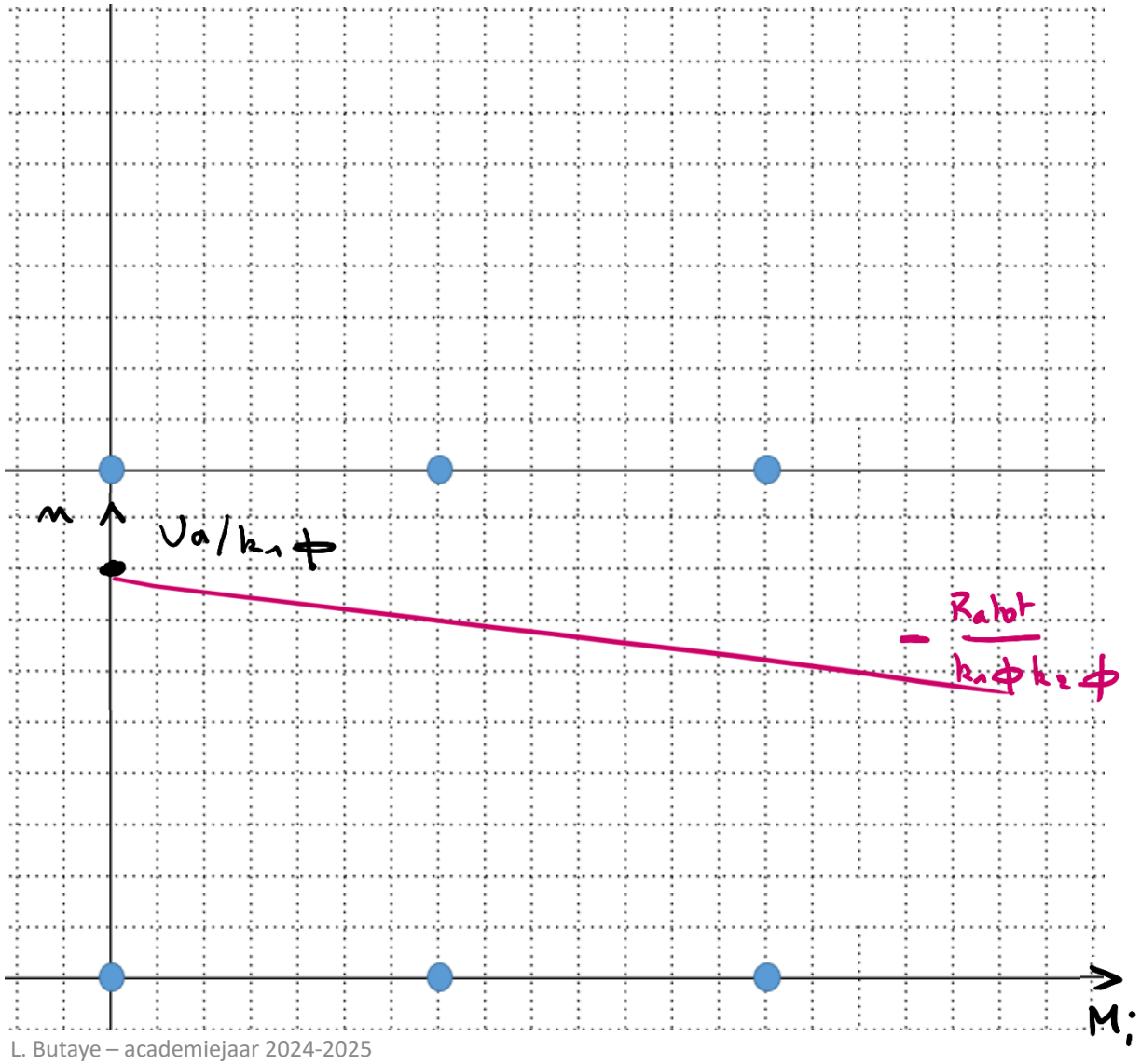
$$n = \frac{U_a}{k_1 \Phi} - \frac{R_{atot}}{k_1 \Phi} \cdot I_a$$

$$M_i = k_2 \Phi I_a$$

$$I_a = \frac{M_i}{k_2 \Phi}$$

$$n = \frac{U_a}{k_1 \Phi} - \frac{R_{atot}}{k_1 \Phi} \cdot \frac{1}{k_2 \Phi} \cdot M_i$$

Rico



1.11 Shunt (DC-)motor

1.11.1. EQ.S.

veld // anker

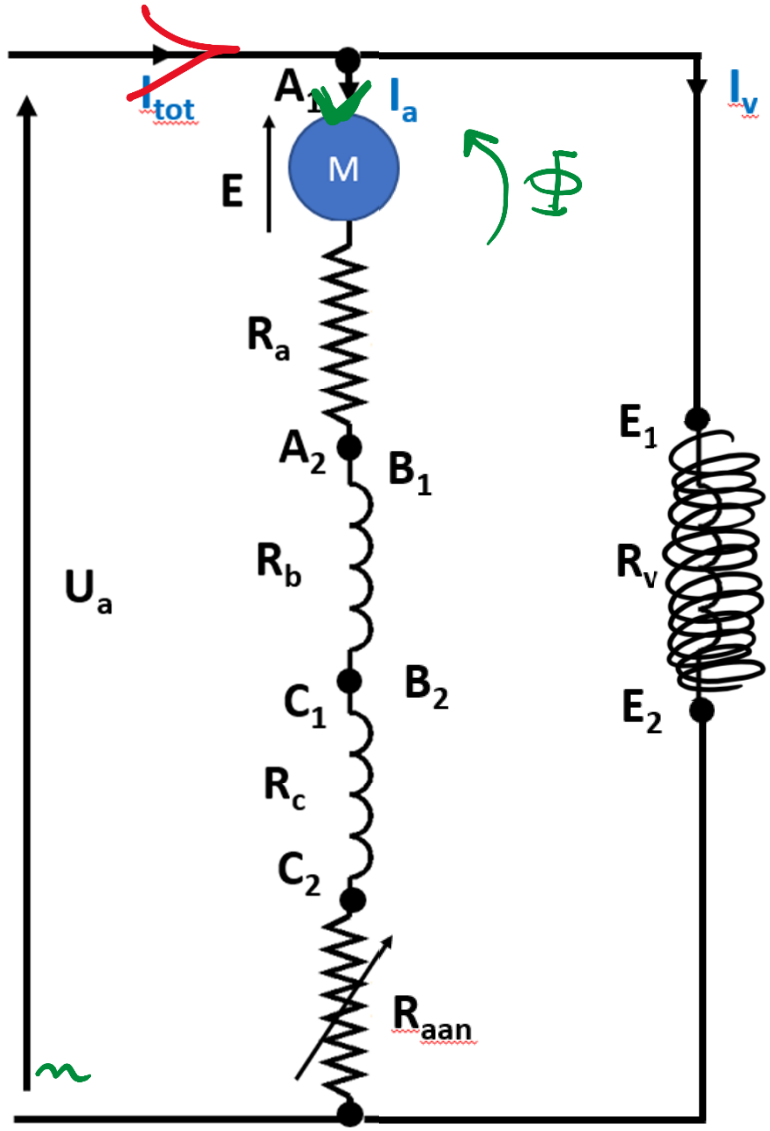
VELD → U_a veel windingen dunne } I_v << → Φ

ANKER $\mathcal{E}$ R_a << → I_a >> → F → M

OEF SHUNT-MOTOR neemt een stroom van 102A

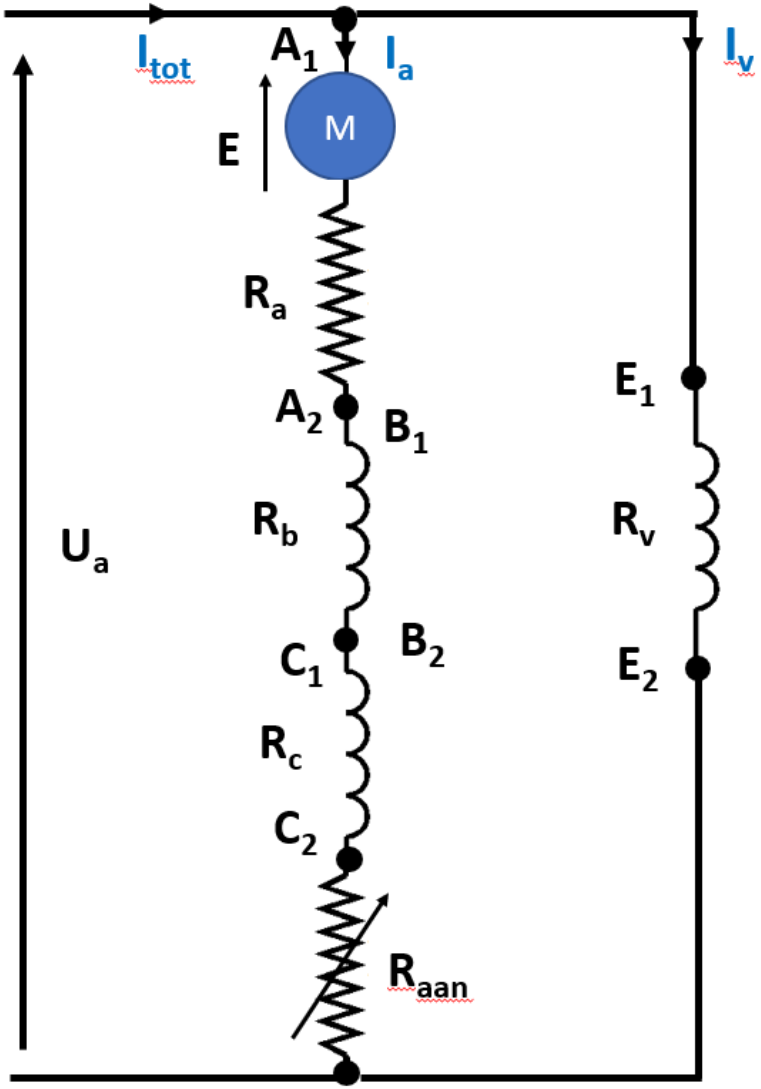
$I_{tot} = 102A$

$I_v = U_a/R_v = 2A$ } → $I_a = 100A$ → E → n



1.11 Shunt (DC-)motor

1.11.1. EQ.S.



1.12 Serie (DC-)motor

1.12.1. EQ.S.

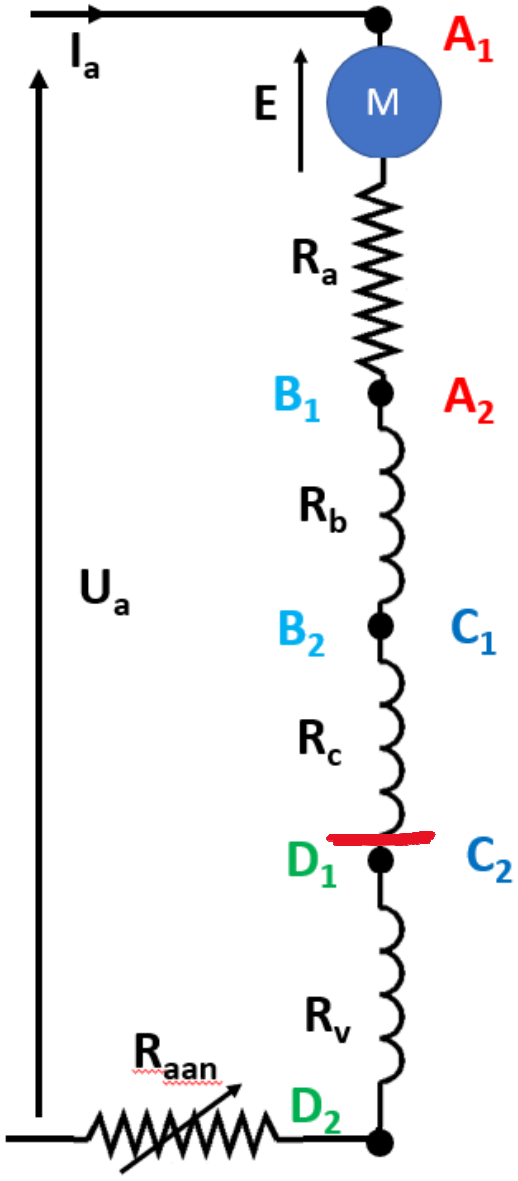
② VELD in serie ANKER

VELDWIKK

D_1 D_2

① I_a >> → weinig windingen → R_v <<

③ Φ ← I_a → LIN (VOOR VERZ) / VERZ (Φ ≃ cte)



1.12 Serie (DC-)motor

1.12.2. Koppel $M_i = f(I_a)$

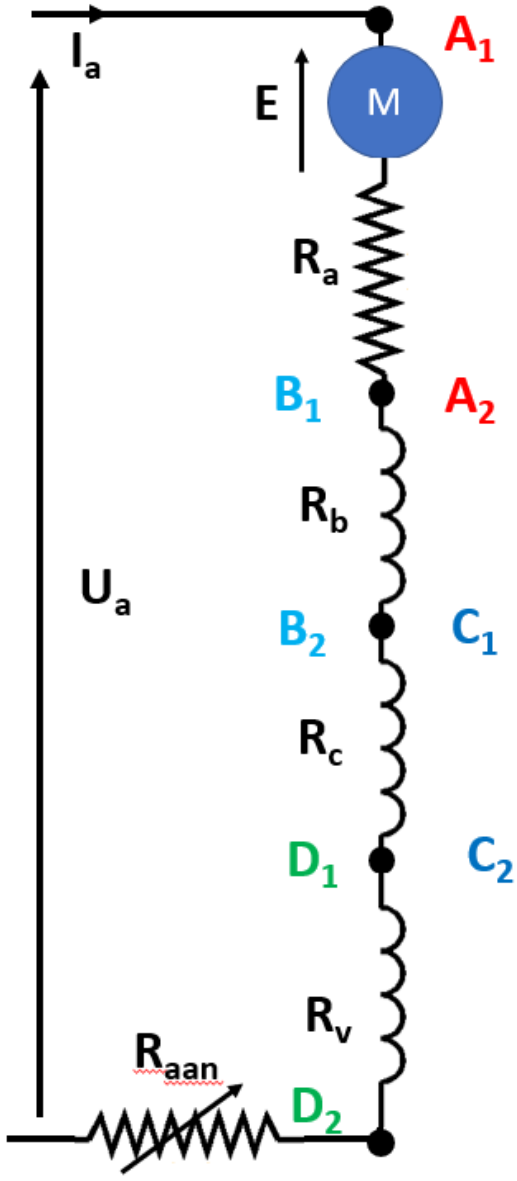
$M_i = k_2 \Phi I_a$

I_a ↓

x

voor vreemd $\Phi \sim I_a \Rightarrow \Phi = k' I_a$

- $M_i = k_2' I_a^2$ kwadr.
- vanaf vreemd $\Phi = c^{te} \rightarrow M_i = k_2'' I_a$



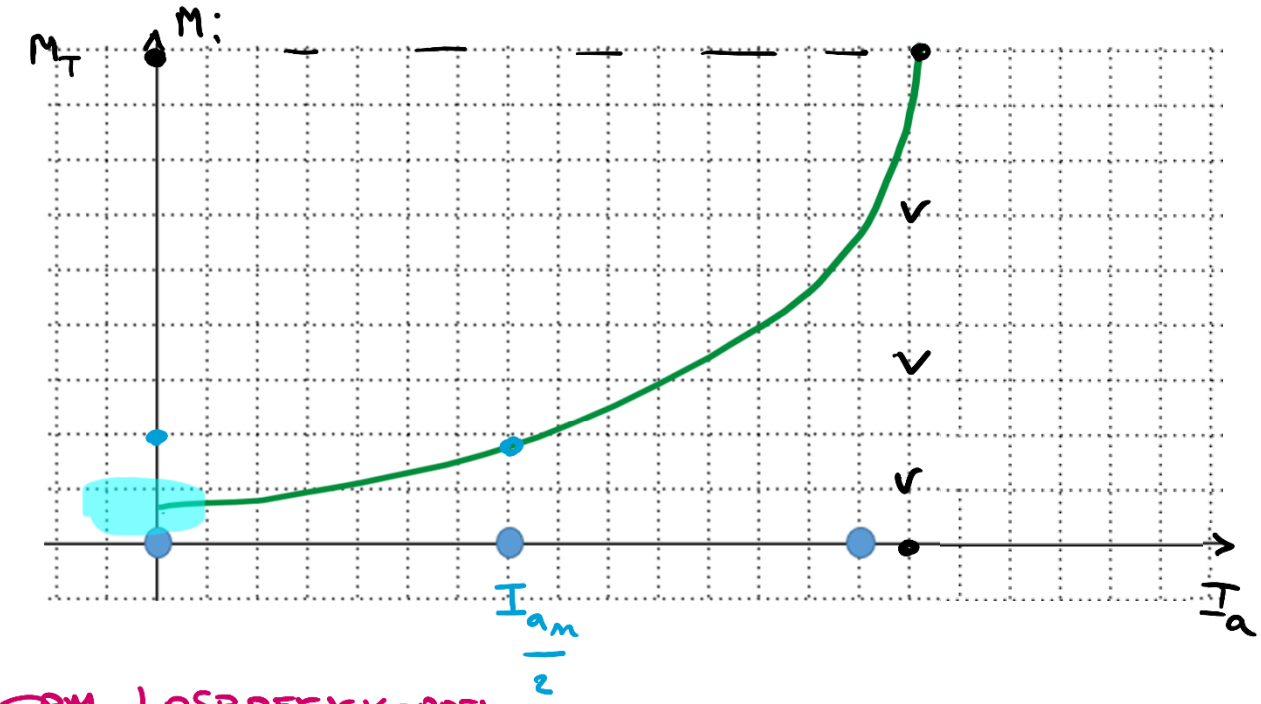
1.12 Serie (DC-)motor

1.12.2. Koppel $M_i = f(I_a)$

1.12 Serie (DC-)motor

1.12.2. Koppel $M_i = f(I_a)$

- $\frac{I_{a\,n}}{2}$
- $M_T \uparrow$
  $\Downarrow$
  $M_i \uparrow$
  - $k_2 \Phi \frac{I_a}{\uparrow}$
  - $I_a \uparrow \rightarrow D_1 \text{---} D_2$
  - $\Phi \uparrow$
  - $M_i \uparrow\uparrow$



OPM LOSBREEKKOPPEL

$1{,}5\ I_{a_n} \rightarrow 2{,}25\ M_i$

1.12 Serie (DC-)motor

1.12.3. Toerental n = f(I_a)

$$E = k_1 \cdot n \cdot \Phi$$

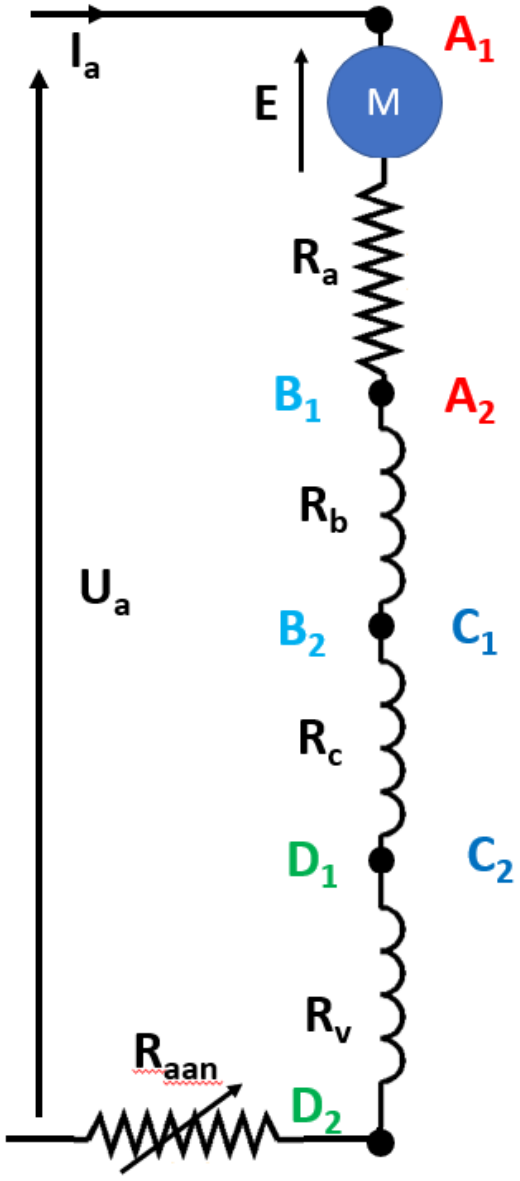
$$n = \frac{U_a - R_{ator} \cdot I_a}{k_1 \cdot \Phi}$$

$\Phi \sim I_a$ voor vez.

$I_a \neq 0$

$I_a \neq \infty$

$$n = \frac{U_a}{k_1' \cdot I_a} - \frac{R_{ator} \cdot I_a}{k_1' \cdot I_a} = \frac{U_a}{k_1' \cdot I_a} - \frac{R_{ator}}{k_1'}$$



1.12 Serie (DC-)motor

1.12.3. Toerental n = f(I_a)

$$n = \frac{V_a}{k_1' I_a} - \frac{R_{ahot}}{k_1'}$$

$$y = \frac{a'}{x} - b'$$

Hyperbool $\longrightarrow$ $\begin{matrix} 0 \\ < \\ \infty \end{matrix}$

1.12 Seriemotor

1.12.3. Toerental n = f(I_a)

$M_{i_0} \overset{?}{=} k_2 \cdot \Phi \cdot I_a$

$\downarrow$

0

$\downarrow$

$I_a = 0$

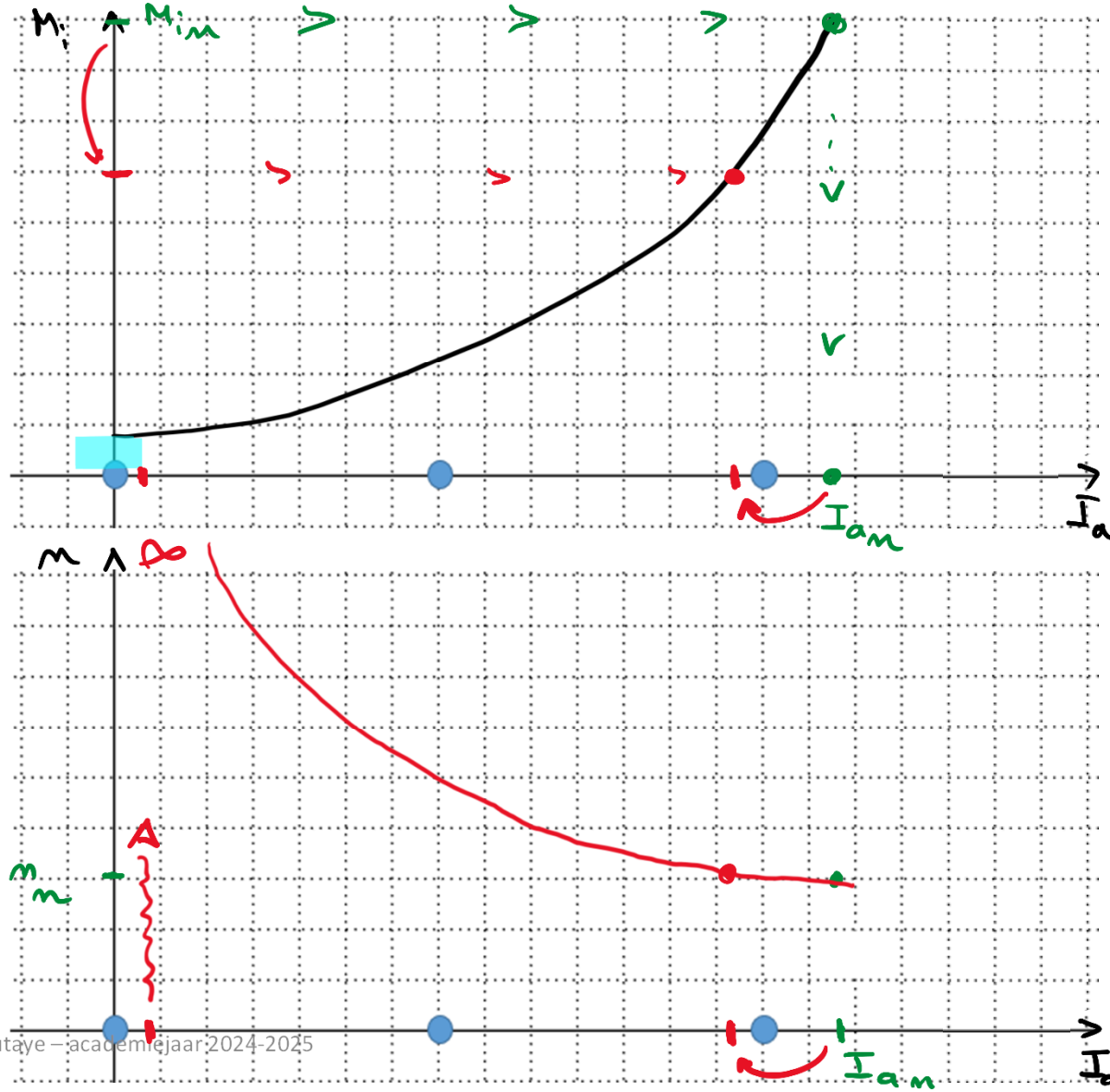
$\downarrow$

$\Phi = 0$

$\downarrow$

$E = k_1 \cdot n \cdot \Phi$

eindig $\quad \infty \quad 0$



1.13 Toerentalvariatie → OB. MOTOR

1.13.1. Toerental n = f(M_i)

1.13 Toerentalvariatie

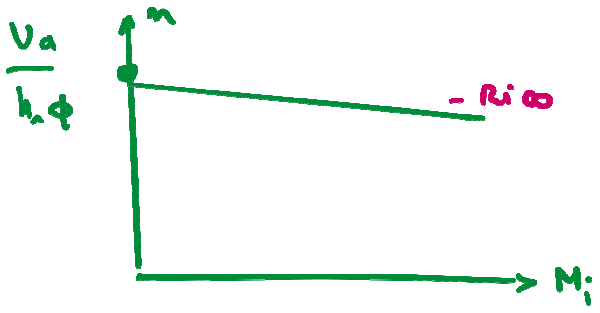
1.13.2. Parameters toerentalvariatie n = f(M_i)

$$E = k_1 . \phi . n$$

$$n = \frac{E}{k_1 . \phi}$$

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

en vermits $Mi = k_2 . \phi . I_a$



$$n = \frac{U_a}{k_1 . \phi} - \frac{R_{a,tot}}{k_1 . \phi . k_2 . \phi} . Mi$$

y

ONAFH VERAND
x

PARAMETERS

Ua

Φ

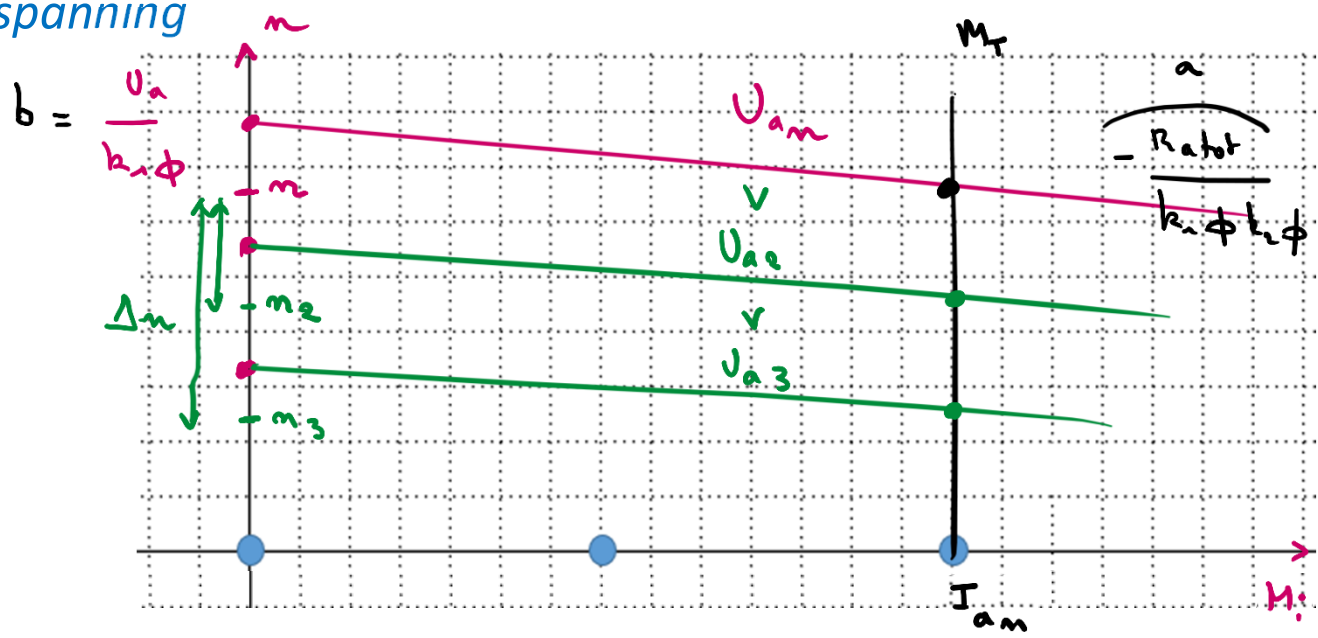
Ra tot

1.13 Toerentalvariatie

1.13.2. Parameters toerentalvariatie n = f(M_i)

1.13.2.1. Variatie in de ankerspanning

$$n = \frac{U_a}{k_1 . \phi} - \frac{R_{a,tot}}{k_1 . \phi . k_2 . \phi} . Mi$$



$b = \frac{U_a}{k_1 \phi}$

$a = -\frac{R_{a\,tot}}{k_1 \phi\, k_2 \phi}$

↳ U_{am}

↳ $U_a \leq U_{am}$

↳ b ↓

a =

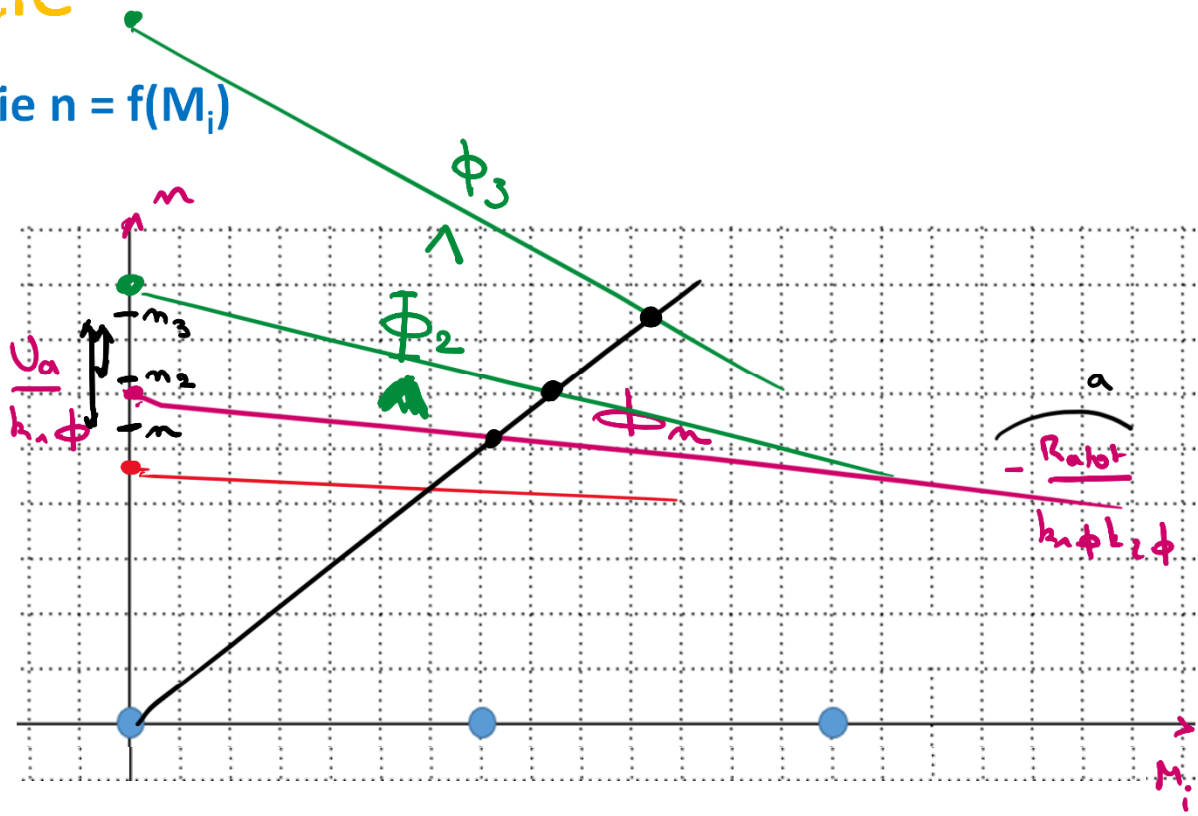
bv $M_T = c^{te}$ ⟶ Δn

1.13 Toerentalvariatie

1.13.2. Parameters toerentalvariatie n = f(M_i)

1.13.2.2. Variatie in het veld

$$n = \frac{U_a}{k_1 . \phi} - \frac{R_{a,tot}}{k_1 . \phi . k_2 . \phi} . Mi$$



$b = \frac{U_a}{k_1 \phi}$

$-\frac{R_{a,tot}}{k_1 \phi k_2 \phi}$

$\phi < \phi_n$ $\phi > \phi_n$

b ↑

Rico groter

n ↑

$M_i = a \cdot n$

1.13 Toerentalvariatie

1.13.2. Parameters toerentalvariatie n = f(M_i)

1.13.2.3. Variatie in de ankerweerstand

$$n = \frac{U_a}{k_1 . \phi} - \frac{R_{a,tot}}{k_1 . \phi . k_2 . \phi} . Mi$$