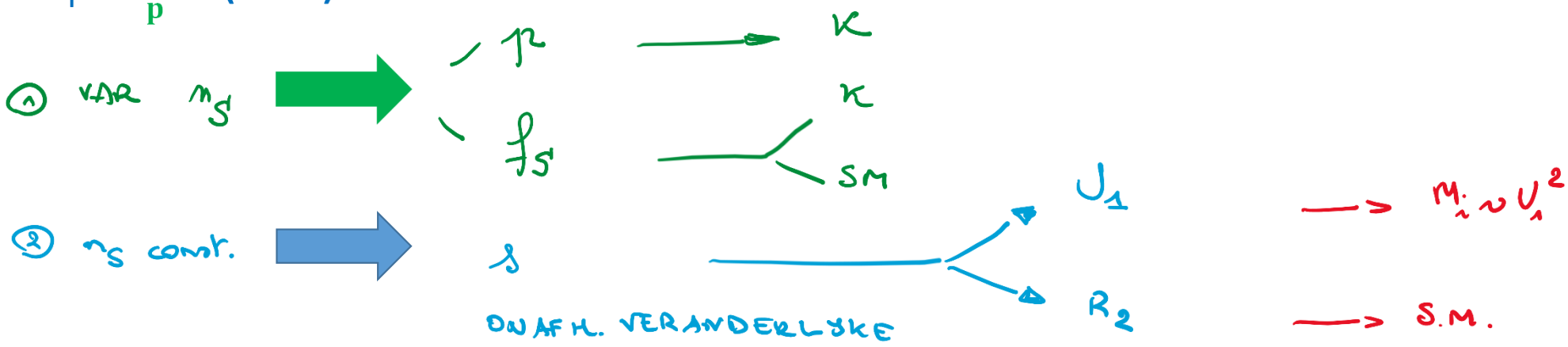
2.13 Toerentalvariatie

2.13.0 Algemeen

$n_r = n_s \cdot (1 - s)$

$n_r = \frac{60 \cdot f_s}{p} \cdot (1 - s)$



2.13 Toerentalvariatie

2.13.1 Poolomschakelbare motoren → # p variabel

- *Meervoudige statorwikkelingen*
  - 2, 3, ...
- *Dahlandermotor*
  - 1

$\#p_s \equiv \#p_r$

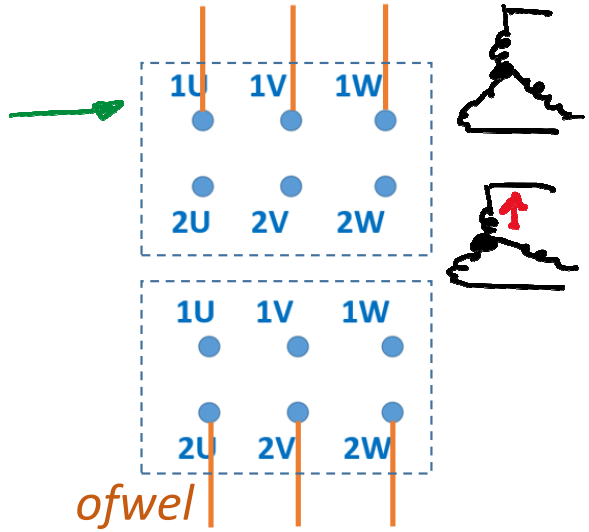
VAR

Rotor → kooirotor

2.13 Toerentalvariatie

2.13.1 Poolomschakelbare motoren

2.13.1.1 Meervoudige statorwikkelingen



2p	2	4	6	8	10	12 …
p	1	2	3	4	5	6 …
n_s (tpm)	3000	1500	1000	750	600	500

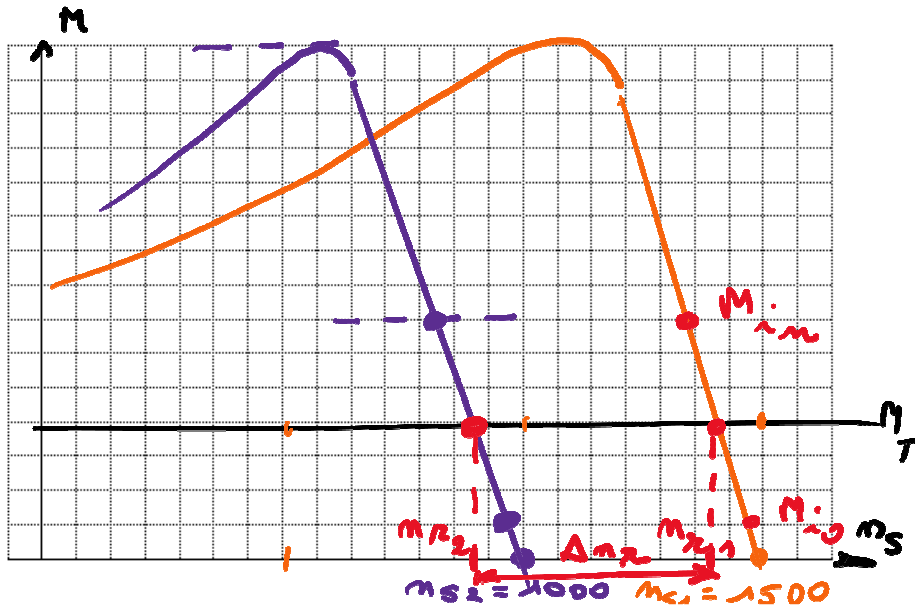
n_s ≠ factor 2

bv. $p = 2 \rightarrow n_{s1}$

$p = 3 \rightarrow n_{s2}$

$M_{ik1} \simeq M_{ik2}$

$M_{im1} \simeq M_{im2}$



2.13 Toerentalvariatie

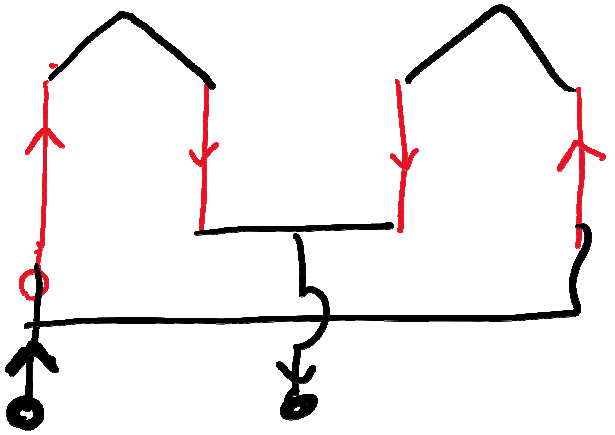
2.13.1 Poolomschakelbare motoren

2.13.1.2 Dahlandermotor

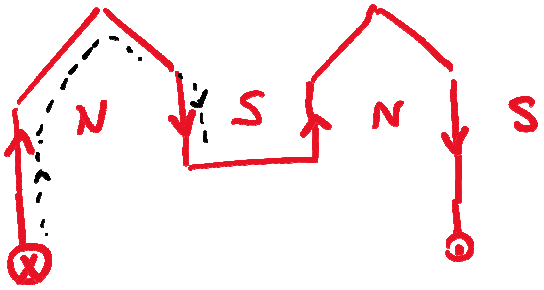
↳ exact factor 2 in ns

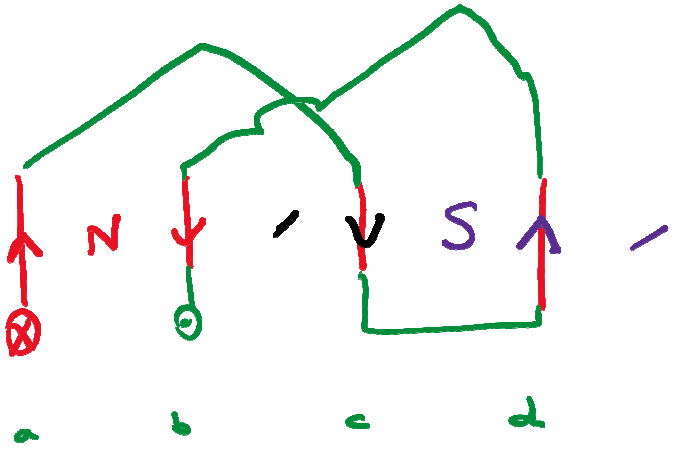
bv. $p = 1$

$p = 2$



$p = 2$ 4polig draaiveld (p. 24) ⟶ $p = 1$ 2polig draaiveld





2.13 Toerentalvariatie

2.13.1 Poolomschakelbare motoren

2.13.1.2 Dahlandermotor

De constructie DM : dezelfde als de driefasige ASM met kooianker.

Het verschil

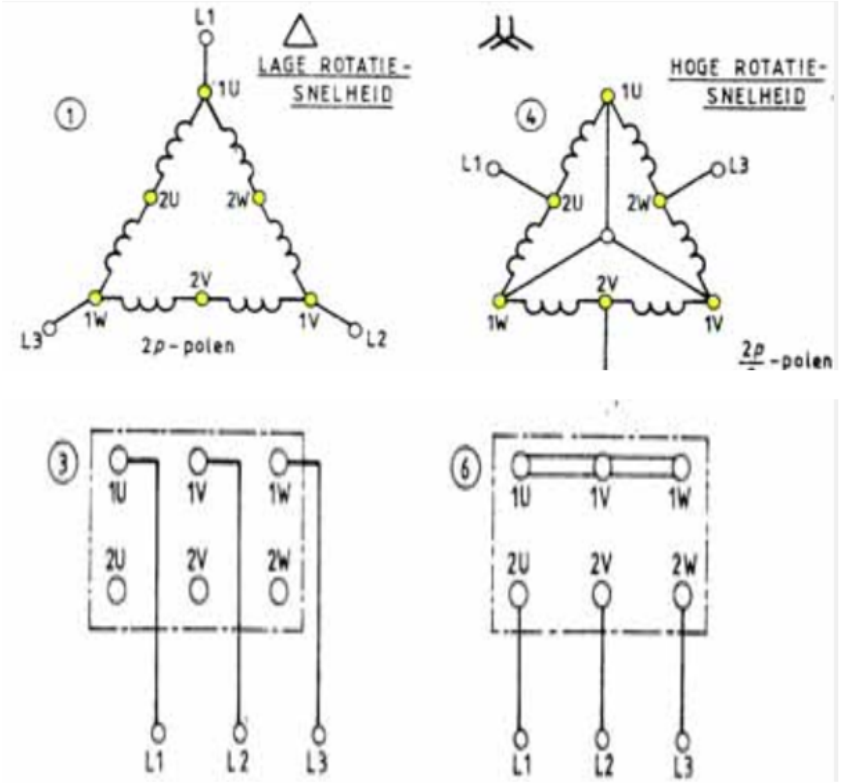
- elk van de drie statorwikkelingen is verdeeld in twee gelijke helften.
- poolparen met verhoudingen 4:2, 8:4 of 12:6.
- De poolomschakeling resp. snelheidswijziging met een factor twee
- Bij het grootste aantal polen - de laagste snelheid - wordt de motor in driehoekschakeling aangesloten. De wikkelingshelften zijn in serie geschakeld.
- Bij het laagst aantal polen - de hoogste snelheid - wordt de motor in dubbelsterschakeling aangesloten. De wikkelingshelften zijn in parallel geschakeld.

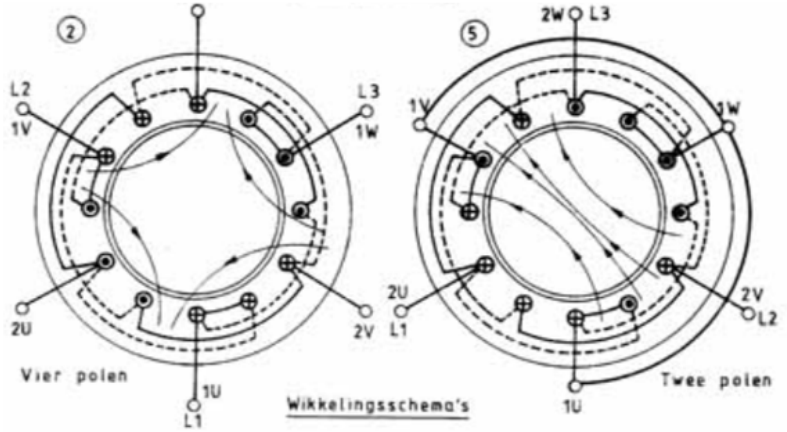
2.13 Toerentalvariatie

2.13.1 Poolomschakelbare motoren

2.13.1.2 Dahlandermotor


Rob. Dahlander.
Fotografi.



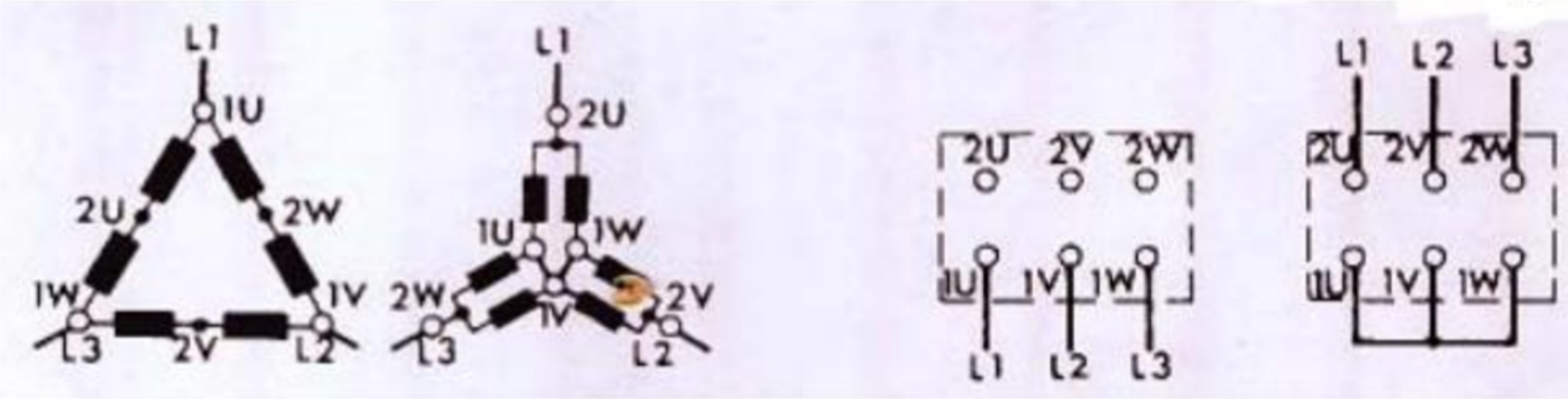


2.13 Toerentalvariatie

2.13.1 Poolomschakelbare motoren

2.13.1.2 Dahlandermotor

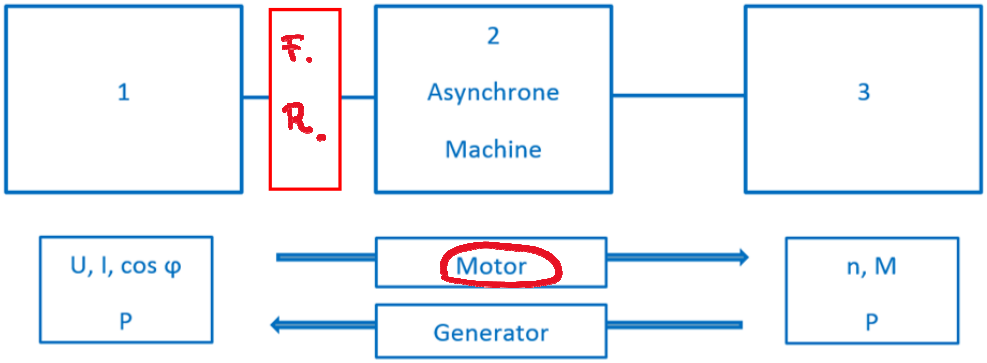
THREE-PHASE ASYNCHRONOUS MOTOR, DAHLANDER, 0.3KW



Low Speed High Speed Low Speed High Speed

2.13 Toerentalvariatie

2.13.2 Frequentieregeling



$f_s \leq 50\,Hz$

3FASIGE SP

$$U_1 \cong E_1 = 4,44 \cdot N_s \cdot f_s \cdot \Phi$$

c^{te}

bv. $\frac{U_{nm}}{f_s}$ $\frac{U_{nm/2}}{f_{s/2}}$ $\frac{U_{nm/4}}{f_{s/4}}$

Φ c^{te}

$f_s > 50\,Hz$

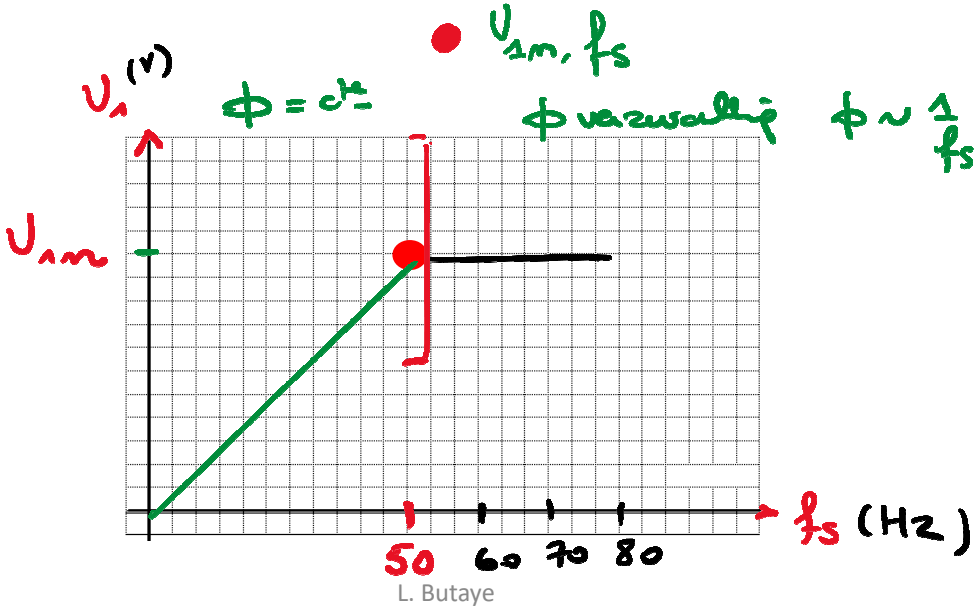
$\Phi \sim \frac{1}{f_s}$

VELDVERZWAKKING

2.13 Toerentalvariatie

2.13.2 Frequentieregeling

$$U_1 \cong E_1 = 4,44 \cdot N_s \cdot f_s \cdot \phi$$



2.13 Toerentalvariatie

2.13.2 Frequentieregeling

nominaal belast

Nominaal inwendig koppel M_{in}

$$M_{in} = k \cdot \Phi \cdot I_{2n}$$

k: constant

$f_s \leq 50\,Hz \longrightarrow \Phi = \text{constant} \longrightarrow M_{in} = k \Phi I_{2n} = \text{constant}$

$f_s > 50\,Hz \longrightarrow \Phi \sim \frac{1}{f_s} \longrightarrow M_{in} \searrow \sim \frac{1}{f_s \uparrow}$

2.13 Toerentalvariatie

$$M_k = \pm \frac{(3)}{\omega_s} \cdot \frac{U_1^2}{(k^2)} \cdot \frac{1}{(2) X_{2,ST}}$$

2.13.2 Frequentieregeling

Kipkoppel M_{ik}

① $f_s \leq 50\,Hz \longrightarrow \frac{U_1}{f_s} = c^{te} \longrightarrow M_k \sim \frac{U_1^2}{\omega_s \cdot \omega_s (L_2)} \sim \frac{U_1^2}{f_s^2}$ $\qquad \omega_s = \frac{2\pi f_s}{p}$

$M_k = c^{te}$

② $f_s > 50\,Hz \qquad \frac{U_{1m}}{f_s}$ $\longrightarrow M_k \sim \frac{U_1^2}{f_s^2} = \frac{U_{1m}^2}{f_s^2}$ VAST $\longrightarrow M_k \sim \frac{1}{f_s^2}$

2.13 Toerentalvariatie

2.13.2 Frequentieregeling

Synchroon toerental n_s $\quad n_s = \frac{60 f_s}{p}$ $\qquad n_s = f(f_s)$ Lin

$\Delta n_k = n_s - n_k = n_s - \left(n_s (1 - s_k) \right)$

$= n_s \cdot s_k$

$\Delta n_k = c_k = \frac{60 f_s}{p} \cdot \frac{R_2}{X_{2sT}} = \frac{60 f_s}{p} \cdot \frac{R_2}{2\pi f_s L_2} = \frac{60 R_2}{2\pi L_2}$ ONAFH FREQ

onafh. freq.

$p = 1$

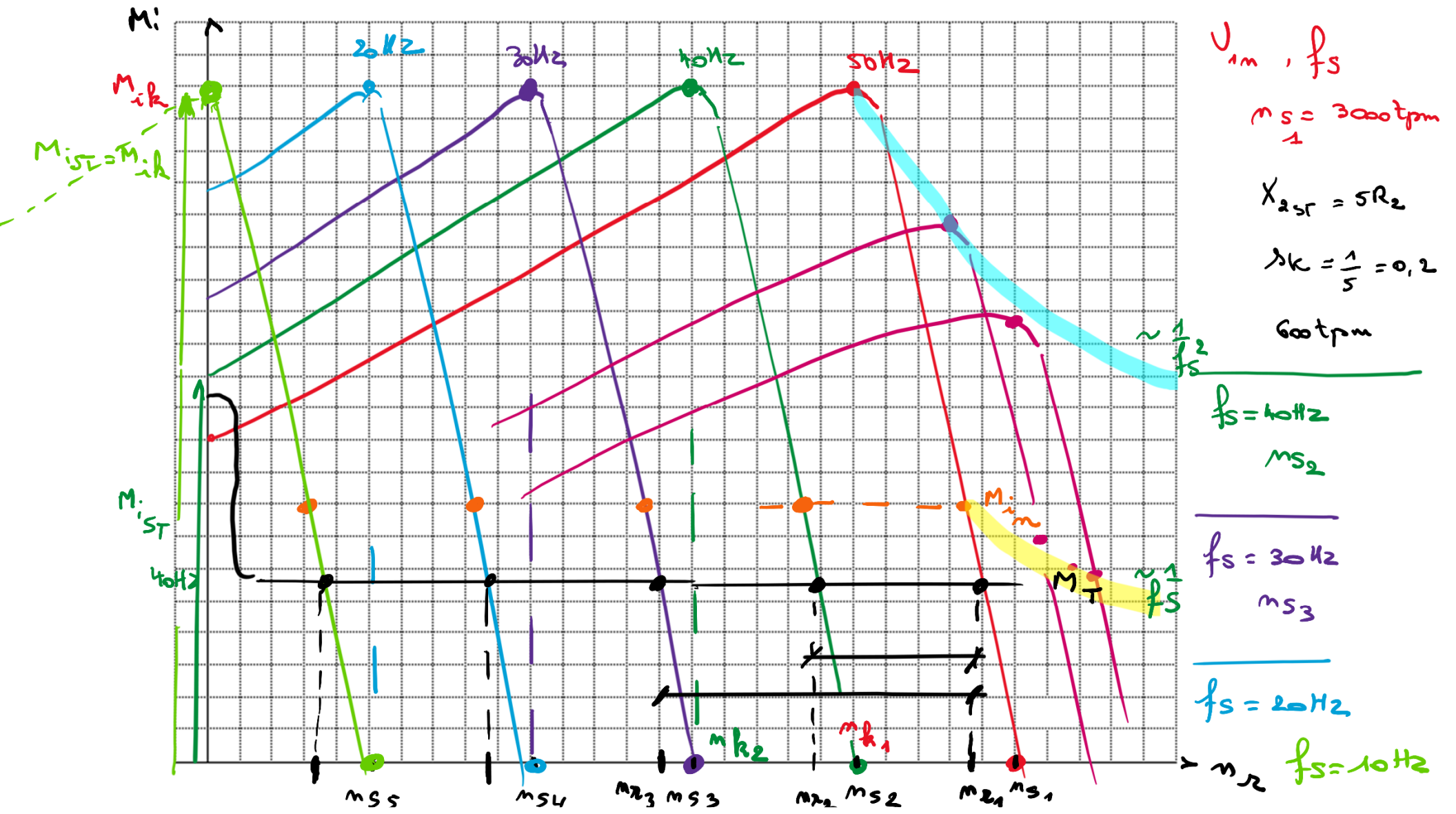
$n_{s_1} = 3000$ tpm 50Hz

$n_{s_2} = 2400$ tpm 40Hz

$n_{s_3} = 1800$ tpm 30Hz

$n_{s_4} = 1200$ tpm 20Hz

$n_{s_5} = 600$ tpm 10Hz


M
M_{ik}
$M_{iST} = M_{ik}$
M_{iST}
50Hz
40Hz
30Hz
20Hz
40Hz
M_{in}
M_T
$\sim \frac{1}{f_s^2}$
$\sim \frac{1}{f_s}$
m_{k2}
m_{k1}
n_{s5}
n_{s4}
n_{z3} n_{s3}
n_{z2} n_{s2}
n_{z1} n_{s1}
n
U_{1m} , f_s
$n_{s1} = 3000$ tpm
$X_{2ST} = 5R_2$
$s_k = \frac{1}{5} = 0,2$
600 tpm
$f_s = 40$ Hz
n_{s2}
$f_s = 30$ Hz
n_{s3}
$f_s = 20$ Hz
$f_s = 10$ Hz