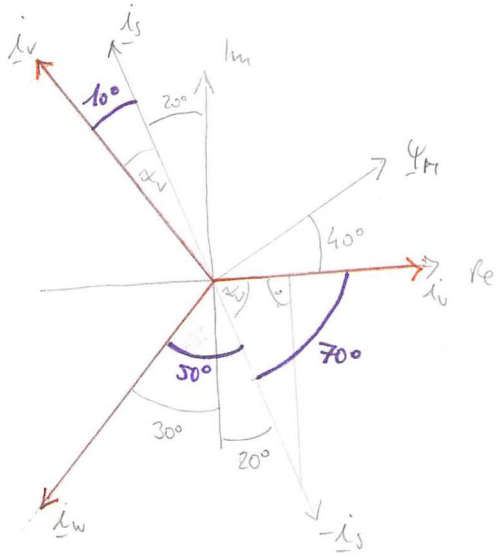
9.12.2014

PSM Y symmetrisch $I_N = 12\,A$ $\underline{\Psi}_M(\tau_0) = 1 \cdot e^{j40°}$

$\underline{i}_S(\tau_0) = 0{,}5 \cdot e^{j110°}$

1) ges: $i_1(\tau_0)$; $i_2(\tau_0)$; $i_3(\tau_0)$; I_1 ; I_2 ; I_3



$$\underline{i}_S = \frac{2}{3} \cdot \left(i_U + \underline{i}_V \cdot e^{j120°} + \underline{i}_W \cdot e^{j240°} \right)$$

$$i = |\underline{i}_S| \cdot \cos(\varphi)$$

$$i_W = -|\underline{i}_S| \cdot \cos(70°) = -0{,}171\,A$$

$$i_V = |\underline{i}_S| \cdot \cos(10°) = 0{,}492\,A$$

$$i_W = -|\underline{i}_S| \cdot \cos(50°) = -0{,}321\,A$$

$$i_1 = \frac{I_1}{I_N \cdot \sqrt{2}} \rightarrow I_1 = i_1 \cdot I_N \cdot \sqrt{2}$$

$\Rightarrow$ $I_1 = -2{,}902\,A$

$I_2 = 8{,}350\,A$

$I_3 = -5{,}448\,A$

$$\underline{i}_S = \frac{2}{3} \cdot \left(-0{,}171 + 0{,}492 \cdot e^{j120°} - 0{,}321 \cdot e^{j240°} \right)$$

$r \cdot e^{j\varphi} = r \cdot \cos(\varphi) + j \cdot \sin(\varphi)$

$$\underline{i}_S = \frac{2}{3} \cdot \left(-0{,}171 - 0{,}246 + j0{,}426 + 0{,}160 + j0{,}277 \right)$$

$$\underline{i}_S = \frac{2}{3} \cdot \left(-0{,}257 + j0{,}703 \right) = -0{,}171 + j0{,}468$$

$r \cdot e^{j\varphi} = a + jb$

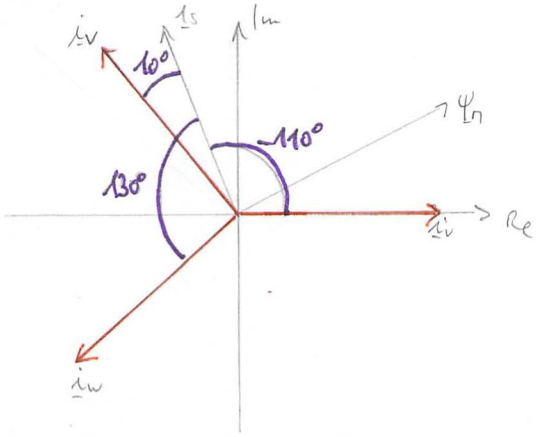
$r = \sqrt{a^2 + b^2} = 0{,}498$

$\varphi = \arctan\left(\frac{a}{b}\right) + \pi = 110°$

$\hookrightarrow a < 0$

$$\underline{i}_S = 0{,}498 \cdot e^{j110°}$$

ALTERNATIV



$\underline{i}_U = |\underline{i}_S| \cdot \cos(-110°) = -0{,}171\,A$

$\underline{i}_V = |\underline{i}_S| \cdot \cos(10°) = 0{,}492\,A$

$\underline{i}_W = |\underline{i}_S| \cdot \cos(130°) = -0{,}321\,A$

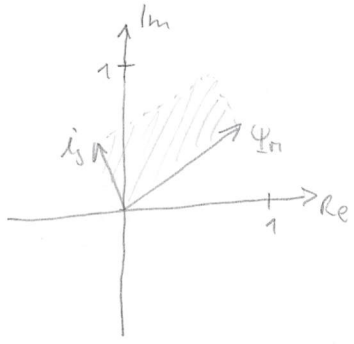
2) Berechne normierte Stromraumzeiger

$\underline{i}_s = 0{,}5 \cdot e^{j 110°}$

$\underline{\psi}_m = 1 \cdot e^{j 40°}$ ← aus Angabe

$\varphi_{\underline{i}s} - \varphi_{\underline{\psi}m} \approx 70°$

$\rightarrow m = i_s \cdot \psi_m \cdot \sin|(\varphi_{is} - \varphi_{\psi m})| = 0{,}469$



3) $m = \frac{1}{2}$ optimale Drehmomentausbeute $\rightarrow i_s \perp \psi_m$

$m = 0{,}5 = \psi_m \cdot i_{s\,opt} \sin(90°)$

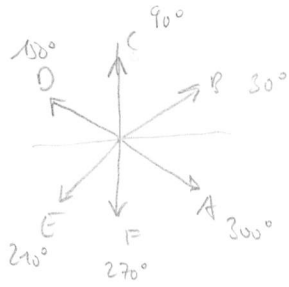
$\rightarrow i_{s\,opt} = 0{,}5$

positive Drehrichtung

$40° + 90° = 130°$

nicht möglich bei BLDC

nächstmögliche Zeige $D = 150°$



$\rightarrow m = i_s \cdot \psi_m \cdot \sin(150° - 40°)$

Zeige D: −U; +V; 0

$0{,}5 = m = i_s \cdot \psi_m \cdot \sin(110°)$

$\rightarrow i_s = 0{,}5 \quad \underline{i}_s = i_s \cdot e^{j 150°}$

$\underline{i}_s = \frac{2}{3}(\underline{i}_u + \underline{i}_v + \underline{i}_w) = \frac{2}{3} i_{zk}(-1 + 1 \cdot e^{j 120°} + 0) = \frac{2}{\sqrt{3}} i_{zk} \cdot e^{j 150°}$

$i_1 = \frac{I_1}{I_N \cdot \sqrt{2}}$

$\rightarrow i_s \cdot e^{j 150°} = \frac{2}{\sqrt{3}} i_{zk} \cdot e^{j 150°}$

$i_s = \frac{2}{\sqrt{3}} i_{zk} \Rightarrow i_{zk} = \frac{\sqrt{3}}{2} \cdot i_s$

$i_{zk} = 0{,}433$

$I_{zk} = i_{zk} \cdot \sqrt{2} \cdot I_N$

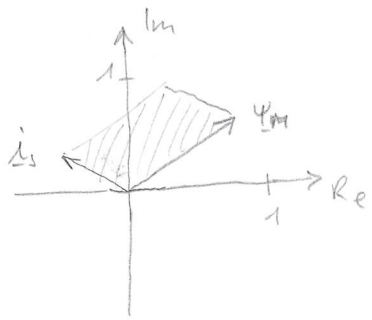
$I_{zk} = 7{,}348\,A$

$\rightarrow I_u = -7{,}348\,A \quad I_v = 7{,}348\,A \quad I_w = 0\,A$

$\Rightarrow$ $i_{2k} = 0{,}433\,A$ $\rightarrow$ $i_1 = -0{,}433\,A$ $i_2 = 0{,}433\,A$ $i_3 = 0$

$I_{2k} = i_{2k} \cdot \sqrt{2}\ I_M = 7{,}348\,A$ $\rightarrow$ $I_1 = -7{,}348\,A$ $I_2 = 7{,}348\,A$ $I_3 = 0$

4) Skizze Raumzeiger $\underline{\psi}_M$ und $\underline{i}_S$



5) bezogene rotorfeste Spannungsraumzeiger für den Betrieb bei 20% Bezugsdrehzahl

$r_S = 0{,}07$ $c_S = 0{,}25$