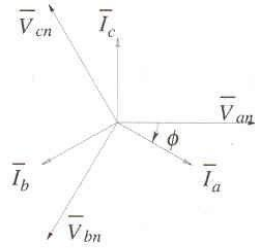
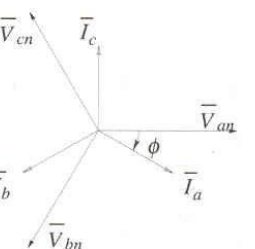
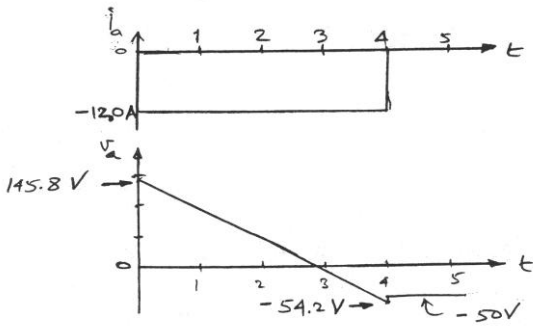
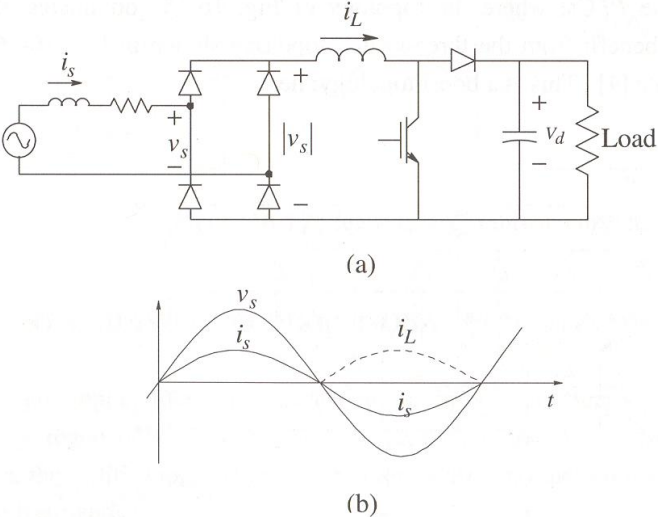


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| Opgave 1 3-9, 3-11 10 punten | 3-9 $P_t = 3.P_f = 3.V.I.\cos\varphi$ $1) I = \frac{P/3}{V.\cos\varphi} = \frac{10000/3}{120 \times 0.9} = 30.86A$ $\cos\varphi = 0.9 \Rightarrow \Phi = 25,84^\circ$ $\bar{V}_a = 120\sqrt{2}\angle 0^\circ V$ $\bar{I}_a = 30.86\sqrt{2}\angle -25.84^\circ V \text{ (lagging)}$ $2) Z = \frac{\bar{V}}{\bar{I}} = \frac{120\sqrt{2}\angle 0^\circ}{30.86\sqrt{2}\angle -25.84^\circ} = 3.89\angle 25.84^\circ \Omega$ | 3) phasor diagram  |
| | 3-11 $4) I_\Delta = I_Y = \frac{P/3}{V.\cos\varphi} = \frac{10000/3}{120 \times 0.9} = 30.86A$ $5) Z_\Delta = 3.Z_Y = 3 \times 3.89 = 11.67\angle 25.84^\circ \Omega$ | 6) phasor diagram  |

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| Opgave 2 5.11 10 punten | 5-11 Reference phasor $\bar{V}_1 = 220\sqrt{2}\angle 0^\circ$ $Z_L = R + jX_L = 0.953 + j0.55 = 1.1\angle 30^\circ \Omega$ Mohan: $X_1 = \left(\frac{N_1}{N_2}\right)^2 Z_L$ $\bar{I}_2' = \frac{V_1}{X_1} = \frac{220\sqrt{2}}{(3)^2 \times 1.1\angle 30^\circ} = 31.43\angle -30^\circ A$ Paul: $\bar{V}_2 = \bar{V}_1 / 3.\sqrt{2} = 220/3 = 103.7\angle 0^\circ V$ $\bar{I}_2 = \frac{\bar{V}_2}{Z_L} = \frac{103.7\angle 0^\circ}{1.1\angle 30^\circ} = 94.28\angle -30^\circ A$ $\bar{I}_1 = \bar{I}_2 / 3 = 31.43\angle -30^\circ A$ $\bar{I}_m = -j\sqrt{2} \times 1.0 = 1.41\angle 90^\circ A$ $\bar{I}_1 = \bar{I}_2' + \bar{I}_m$ $= [31.43\angle -30^\circ - 1.41\angle 90^\circ]$ $= 27.22 - j15.72 - j1.41 = 27.22 - j17.13 = 32.16\angle 32.2^\circ A$ |
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| Opgave 3 10 punten | 7-1 Bij $T = 0 \text{ Nm}$ $V_a = E_a = k_E \cdot \omega_m \Rightarrow I_a = 0 \text{ A}$ $\omega_m = \frac{E_a}{k_E}$ $100 \text{ V} \Rightarrow \omega_m = \frac{100}{0.5} = 200 \text{ rad/sec}$ $60 \text{ V} \Rightarrow \omega_m = \frac{60}{0.5} = 120 \text{ rad/sec}$ | 7-1 Bij $T = 4 \text{ Nm}$: $V_a = k_E \cdot \omega_m - R_a \cdot I_a \Rightarrow I_a = \frac{T}{k_T} = \frac{4.0}{0.5} = 8.0 \text{ A}$ $\omega_m = \frac{V_a - R_a \cdot I_a}{k_E}$ $100 \text{ V} \Rightarrow$ $\omega_m = \frac{100 - 0,358}{0.5} = 194.4 \text{ rad/sec}$ $60 \text{ V} \Rightarrow \omega_m = \frac{60 - 0,35 \times 8}{0.5} = 114.4 \text{ rad/sec}$ |
| 7-9 | Goed: $\Delta\omega = -100 - 300 = -400 \text{ rad/sec}$ $J_t = J_m + J_l = 0.02 + 0.04 = 0,06 \text{ kg.m}^2$ $T_{em} = J_t \frac{\Delta\omega_m}{\Delta t} = 0.06 \frac{-400}{4 \text{ sec}} = -6.0 \text{ Nm}$ $I_a = \frac{T}{k_T} = \frac{-6.0}{0.5} = -12.0 \text{ A}$ $\omega_m(t) = 300 - \frac{400}{4}t = 300 - 100t$ $e_a = k_E \cdot \omega_m = 0,5(300 - 100t) = (150 - 50t) \text{ V}$ $V_a = e_a + R_a \cdot I_a = (150 - 50t) - 0.35 \times 12$ $V_a = 150 - 50t - 4.2 \text{ V}$ bij $t = 0$; $V_a = 150 - 0 - 4.2 = 145.8 \text{ V}$ bij $t = 4 \text{ sec}$; $V_a = 150 - 200 - 4.2 = -54.2 \text{ V}$ na 4 sec ; $I_a = 0 \Rightarrow V_a = e_a = -50 \text{ V}$  | Fout: $\Delta\omega = 100 - 300 = -200 \text{ rad/sec}$ $J_t = J_m + J_l = 0,02 + 0,04 = 0,06 \text{ kg.m}^2$ $T_{em} = J_t \frac{\Delta\omega_m}{\Delta t} = 0.06 \frac{-200}{4 \text{ sec}} = -3.0 \text{ Nm}$ $I_a = \frac{T}{k_T} = \frac{-3.0}{0.5} = -6,0 \text{ A}$ $\omega_m(t) = 300 - \frac{200}{4}t = 300 - 50t$ $e_a = k_E \cdot \omega_m = 0,5(300 - 50t) = (150 - 25t) \text{ V}$ $\bar{V}_a = e_a + R_a \cdot I_a = (150 - 25t) - 0.35 \times 6$ $\bar{V}_a = 150 - 25t - 2.1 \text{ V}$ bij $t = 0$; $V_a = 150 - 2.1 = 147.9 \text{ V}$ bij $t = 4 \text{ sec}$; $V_a = 150 - 100 - 2.1 = 47.9 \text{ V}$ na 4 sec ; $I_a = 0 \Rightarrow V_a = e_a = 50 \text{ V}$ |

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| Vraag 1 2 punten | Watt vermogen => P / W Blind vermogen => Q / VAr Schijnbaar vermogen => S / VA $S = P + jQ$ |
| Vraag 2 2 punten | Twee kwadranten => 1 en 2 |
| Vraag 3 2 punten | Een hijskraan werkt in 4 kwadranten Een (enkele) converter werkt in 2 kwadranten Schema: twee converters anti parallel |
| Vraag 4 2 punten | Beschrijving vanaf bladzijde 16-21 $V_d > \hat{V}_s$  <p>(a)</p> <p>(b)</p> |
| Vraag 5 2 punten | $\hat{V} = V_{eff} \times \sqrt{2} = 325V$ Zonder condensator: $V_{out} = \hat{V} \times \frac{2}{\pi} = 207V$ Met condensator: $V_{out} = \hat{V} = 325V$ Zie formuleblad –Wisselspanning |