Opgave 1

3-7

10 punten

Oplossing:

$X_L = \omega L = 314.16 \times 16 \times 10^{-3} = 5.02\Omega \; ; R = 6.8\Omega$

$Z = R + jX_L = 8.44\Omega \angle 36.4°$

$\rho = 36.4°$

$S = \frac{V^2}{Z} = \frac{230^2}{8.44} = 6297.6VA$

$P_R = S.\cos\rho = 6297.6 \times 0.8 = 5038W$

$Q_L = S.\sin\rho = 6297.6 \times 0.59 = 3716VAR$

$Q_C = -Q_L = -3716VAR$

$C = \frac{Q_C}{V^2.\omega} = \frac{3716}{230^2.314} \approx 224\mu F$

Opgave 2a

5-11

7 punten

Oplossing:

Reference phasor $\bar{V}_1 = 230\sqrt{2}\angle 0°$

$Z_L = R + jX_L = 1.9 + j1.1 = 2.2\angle 30°\Omega$

$Z_1 = \left(\frac{N_1}{N_2}\right)^2 Z_L$

$\bar{I}_2' = \frac{V_1}{Z_1} = \frac{230\sqrt{2}}{(3)^2 \times 2.2\angle 30°} = 16.43\angle -30° A$

Of:

$\bar{V}_2 = \bar{V}_1 / 3.\sqrt{2} = 230\sqrt{2}/3 = 108.4\angle 0°V$

$\bar{I}_2 = \frac{\bar{V}_2}{Z_L} = \frac{108.4\angle 0°}{2.2\angle 30°} = 49.27\angle -30° A$

$\bar{I}_1 = \bar{I}_2 / 3 = 16.42\angle -30° A$

$\bar{I}_m = -j\sqrt{2} \times 1.0 = 1.41\angle 90° A$

$\bar{I}_1 = \bar{I}'_2 + \bar{I}_m$

$= [16.43\angle -30° - 1.41\angle 90 \circ]$

$= 14.23 - j8.22 - j1.41 = 14.23 - j9.63 = 17.18\angle -34.01° A$

Opgave 2b

3 punten

de amplitude en fase van I_1.

$\bar{I}_3' = \frac{V_3}{R} = \frac{230\sqrt{2}}{(3)^2 \times 2.2\angle 0°} = 16.43A$

$\bar{I}_1 = \bar{I}'_2 + \bar{I}_m + \bar{I}'_3$

$= 14.23 - j8.22 - j1.41 + 16.43 = 30.66 - j9.63 = 31.37\angle -17.45° A$

Opgave 3a

7-1

3 punten

Oplossing 1:
Voor 120V:

Bij T= 0 Nm => $I_a = 0A;\ \omega_m = \frac{E_a}{k_E} = \frac{120}{0.5} = 240 rad/\sec$

Bij T= 4 Nm: => $I_a = \frac{T}{k_T} = \frac{4.0}{0.5} = 8.0A$

$$\omega_m = \frac{V_a - R_a.I_a}{k_E} = \frac{120 - 0{,}35 \times 8}{0.5} = 234.4 rad/\sec$$

Voor 70V:

Bij T= 0 Nm => $I_a = 0A;\ \omega_m = \frac{E_a}{k_E} = \frac{70}{0.5} = 140 rad/\sec$

Bij T= 4 Nm: => $I_a = \frac{T}{k_T} = \frac{4.0}{0.5} = 8.0A$

$$\omega_m = \frac{V_a - R_a.I_a}{k_E} = \frac{70 - 0{,}35 \times 8}{0.5} = 134.4 rad/\sec$$

Opgave 3a

7-7

7 punten

Oplossing:

$$\omega_{m1} = \frac{1500}{60} 2\pi = 157.08 rad/\sec$$

$$\omega_{m2} = \frac{750}{60} 2\pi = 78.54 rad/\sec$$

$$J_t = J_m + J_l = 0.02 + 0.04 = 0.06 kg.m^2$$

$$\Delta E_{inertia} = \frac{1}{2} J_t \left[\omega_1^2 - \omega_2^2\right] = \frac{0.06\left[157.08^2 - 78.54^2\right]}{2} = 555.17 J$$

$$T_{em} = k_T |I_a| = 0.5 \times 10 = 5 Nm$$

$$\Delta t = (\omega_{m1} - \omega_{m2}) \frac{J_t}{T_{em}} = 78.54 \times \frac{0.06}{5} = 0.942 \sec$$

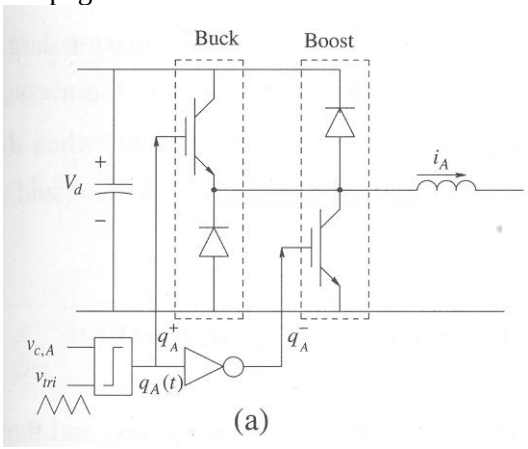
$$E_{loss} = R_a I_a^2 \Delta t = 0.35 \times 10^2 \times 0.942 = 32.97 J$$

$$E_{recoverd} = \Delta E_{in} - E_{loss} = 555.7 - 32.97 = 522 J$$

Vraag 1

2 punten

Zie pagina 4-17



Twee kwadranten, 1 en 2.

Vraag 2

3 punten

Zie pagina 16-28, pagina 16-28 / 16-31

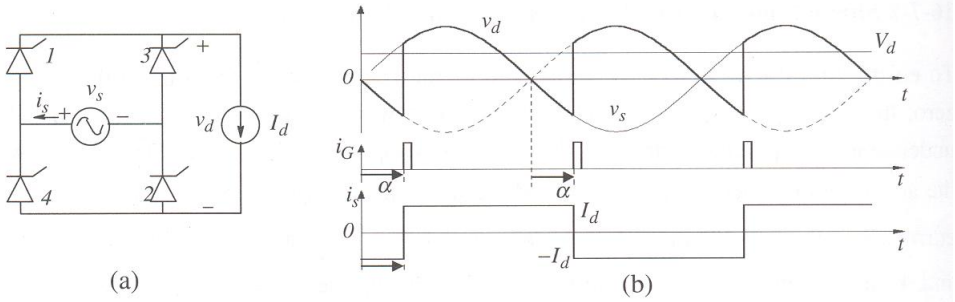


Figure16-21 (a) Simplified circuit diagram of the converter; (b) waveforms.

$$v_d(t) = -v_s(t) \quad \text{and} \quad i_s(t) = -I_d \qquad \alpha + \frac{\pi}{2} < \omega t \le \alpha + \pi \qquad (16\text{-}29)$$

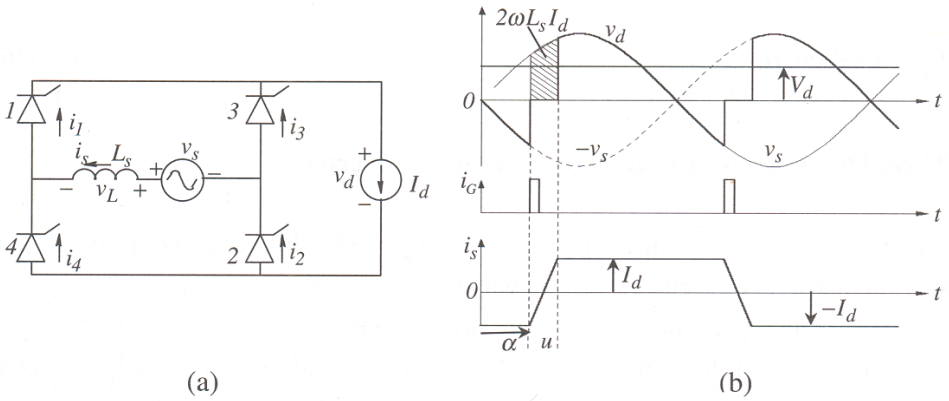
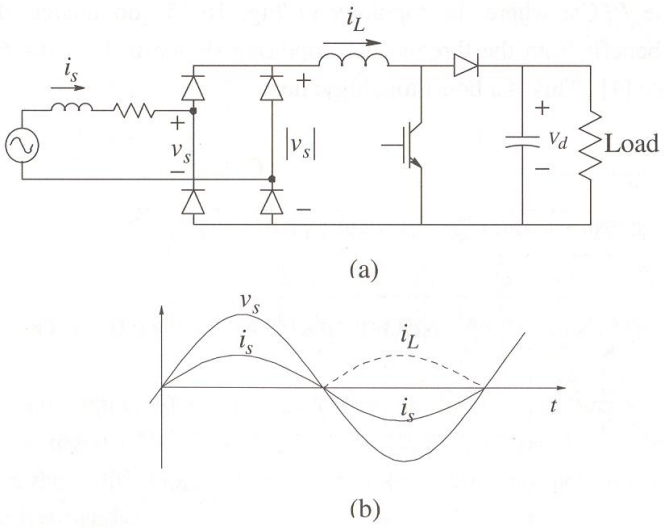
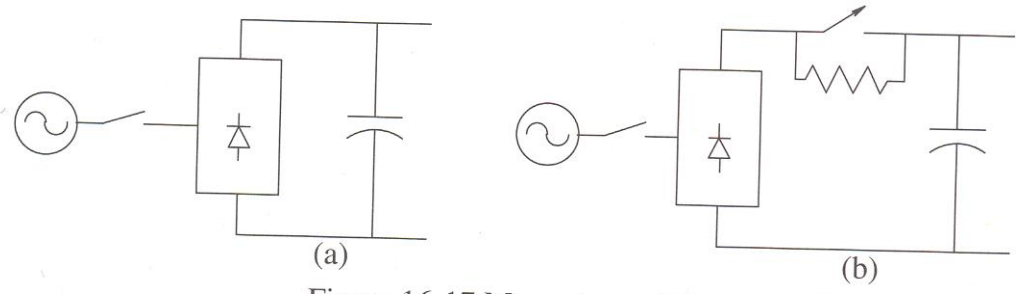


Figure 16-24 (a) Thyristor converter along with source inductance; (b) waveforms.

$$\frac{\omega L_S I_S}{T}$$

Vraag 3 2 punten	Beschrijving vanaf bladzijde 16-21 $V_d > \hat{V}_s$  (a) (b)
Vraag 4 1 punten	Zie pagina 16-23  Figure 16-17 Means to avoid inrush current
Vraag 5 2 punten	Twee fasen verwisselen $\omega_r = \omega_s(1-s);\ \omega_s = \dfrac{60 \times f}{p/2}$