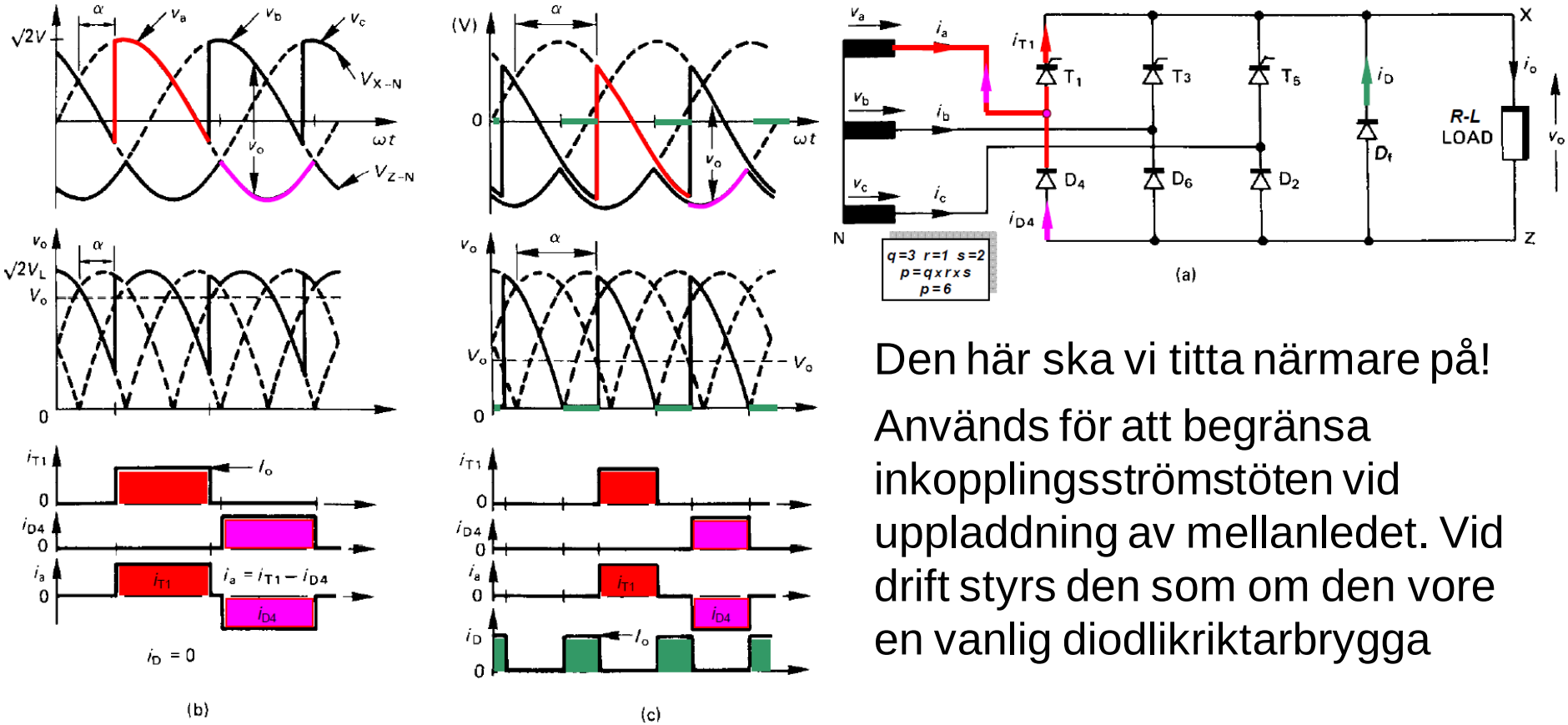
Halvstyrd trefas likriktarbrygga (I)

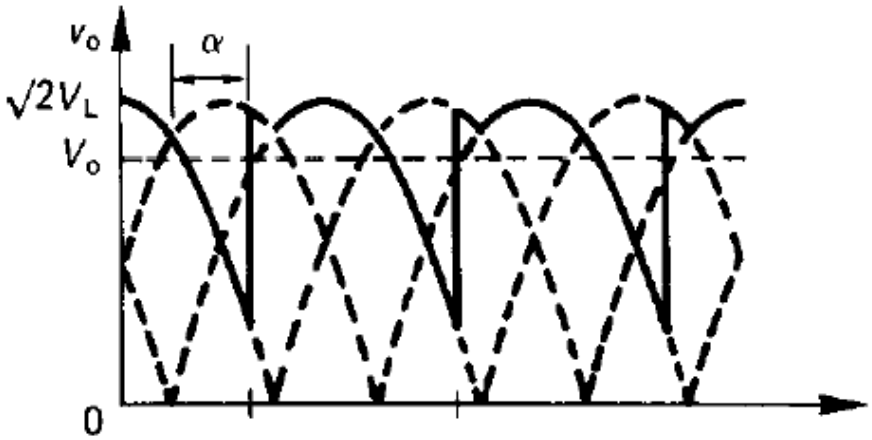


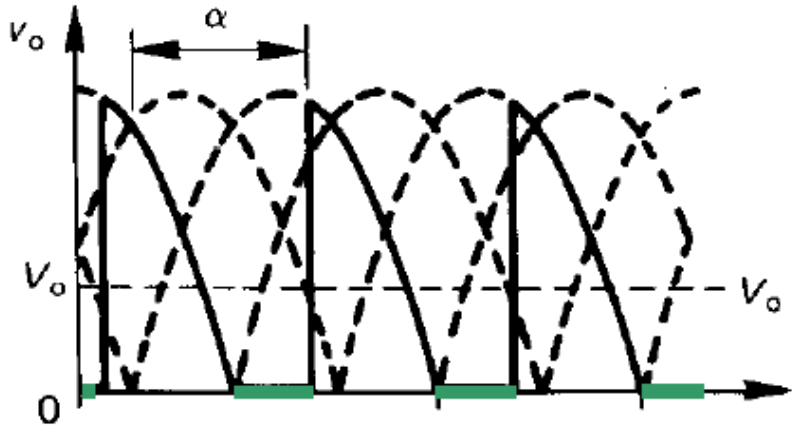
Den här ska vi titta närmare på!

Används för att begränsa inkopplingsströmstöten vid uppladdning av mellanledet. Vid drift styrs den som om den vore en vanlig diodlikriktarbrygga

Figure 12.10. *Three-phase half-controlled bridge converter: (a) circuit connection; (b) voltage and current waveforms for a small firing delay angle α; and (c) waveforms for a large.*

Halvstyrd trefas likriktarbrygga (II)





$$0 \le \alpha \le \pi/3 \qquad v_o(t) = \begin{cases} \sqrt{2}V_L \cdot \cos(\omega t) & \pi/6 \le \omega t < \pi/6 + \alpha \\ \sqrt{2}V_L \cdot \cos(\omega t - \pi/3) & \pi/6 + \alpha \le \omega t < \pi/6 + \pi/3 = \pi/2 \\ \sqrt{2}V_L \cdot \cos(\omega t - 2\pi/3) & \pi/2 \le \omega t \le 5\pi/6 \end{cases}$$

$$\pi/3 \le \alpha \le \pi \qquad v_o(t) = \begin{cases} \sqrt{2}V_L \cdot \cos(\omega t) & \pi/6 \le \omega t < \pi/2 \\ 0 & \pi/2 \le \omega t < \pi/6 + \alpha \\ \sqrt{2}V_L \cdot \cos(\omega t - 2\pi/3) & \pi/6 + \alpha \le \omega t \le 5\pi/6 \end{cases}$$

Halvstyrd trefas likriktarbrygga (III)

- Tre distinkta intervall i båda fallen!
- Pulsmönstret upprepas 3 gånger per period!
- Beräkna medelspänningen:

$$\bar{V}_o(t) = \frac{1}{T}\int_T v_o(t)dt = \frac{1}{T}\int_T v_o(t)dt = \frac{1}{T/3}\int_{T/3} v_o(t)dt =$$

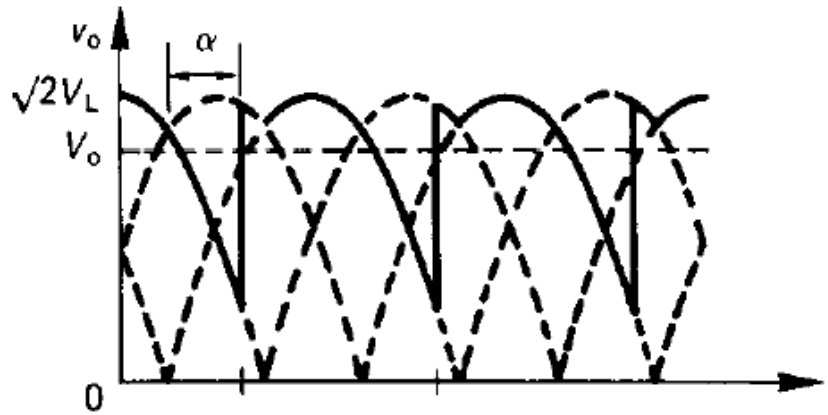
$$= \frac{1}{T/3}\cdot\frac{1}{\omega}\int_{\omega T/3} v_o(\omega t)d\omega t = \frac{3}{\omega T}\int_{\omega T/3} v_o(\omega t)d\omega t =$$

$$= \frac{3}{2\pi}\int_{2\pi/3} v_o(\omega t)d\omega t = \frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} v_o(\omega t)d\omega t$$

Halvstyrd trefas likriktarbrygga (IV)

$0 \le \alpha \le \pi/3$

$$v_o(t) = \begin{cases} \sqrt{2}V_L \cdot \cos(\omega t) & \pi/6 \le \omega t < \pi/6 + \alpha \\ \sqrt{2}V_L \cdot \cos(\omega t - \pi/3) & \pi/6 + \alpha \le \omega t < \pi/6 + \pi/3 = \pi/2 \\ \sqrt{2}V_L \cdot \cos(\omega t - 2\pi/3) & \pi/2 \le \omega t \le 5\pi/6 \end{cases}$$



$$\overline{V}_o(t) = \frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} v_o(\omega t)\,d\omega t =$$

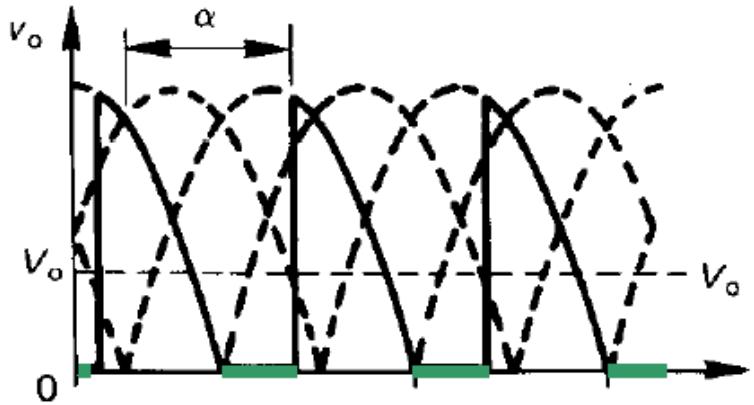
$$= \frac{3}{2\pi}\left(\int_{\pi/6}^{\pi/6+\alpha} v_o(\omega t)\,d\omega t + \int_{\pi/6+\alpha}^{\pi/2} v_o(\omega t)\,d\omega t + \int_{\pi/2}^{5\pi/6} v_o(\omega t)\,d\omega t\right) =$$

$$\frac{3\sqrt{2}}{2\pi} \cdot V_L \cdot (1 + \cos\alpha)$$

Halvstyrd trefas likriktarbrygga (V)

$\pi/3 \le \alpha \le \pi$

$$v_o(t) = \begin{cases} \sqrt{2}V_L \cdot \cos(\omega t) & \pi/6 \le \omega t < \pi/2 \\ 0 & \pi/2 \le \omega t < \pi/6 + \alpha \\ \sqrt{2}V_L \cdot \cos(\omega t - 2\pi/3) & \pi/6 + \alpha \le \omega t \le 5\pi/6 \end{cases}$$



$$\overline{V_o}(t) = \frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} v_o(\omega t)\,d\omega t =$$

$$= \frac{3}{2\pi}\left(\int_{\pi/6}^{\pi/2} v_o(\omega t)\,d\omega t + \int_{\pi/2}^{\pi/6+\alpha} v_o(\omega t)\,d\omega t + \int_{\pi/6+\alpha}^{5\pi/6} v_o(\omega t)\,d\omega t\right) =$$

$$\frac{3\sqrt{2}}{2\pi} \cdot V_L \cdot (1 + \cos\alpha)$$

Halvstyrd trefas likriktarbrygga (VII) - Kommuteringshack

- Kommuteringsvinkeln γ ges av (se ekvation 12.187):

$$\cos(\alpha)-\cos(\alpha+\gamma)=\sqrt{\frac{2}{3}}\cdot\frac{\omega L I_o}{V} \quad \Leftrightarrow$$

$$\cos(\alpha+\gamma)=\cos(\alpha)-\sqrt{\frac{2}{3}}\cdot\frac{\omega L I_o}{V}=\cos(\alpha)-\sqrt{\frac{2}{3}}\cdot\frac{2\pi 50\cdot 0.5\cdot 10^{-3}\cdot 100}{415/\sqrt{3}}$$

$\alpha=\pi/6$ $$\cos(\alpha+\gamma)=\cos\left(\frac{\pi}{6}\right)-\sqrt{\frac{2}{3}}\cdot\frac{2\pi 50\cdot 0.5\cdot 10^{-3}\cdot 100}{415/\sqrt{3}}=0.8125$$

$$\gamma=\cos^{-1}(0.8125)-\frac{\pi}{6}\,\text{rad}=0.09878\,\text{rad}=5.66^\circ$$

$\alpha=2\pi/3$ $$\gamma=\cos^{-1}(-0.5535)-\frac{2\pi}{3}\,\text{rad}=0.06300\,\text{rad}=3.61^\circ$$