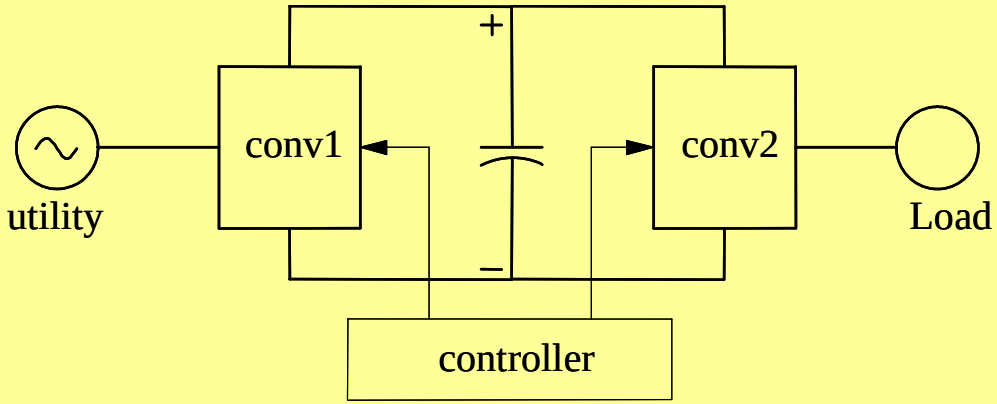
Ancillary Topics in Switch-Mode Inverters

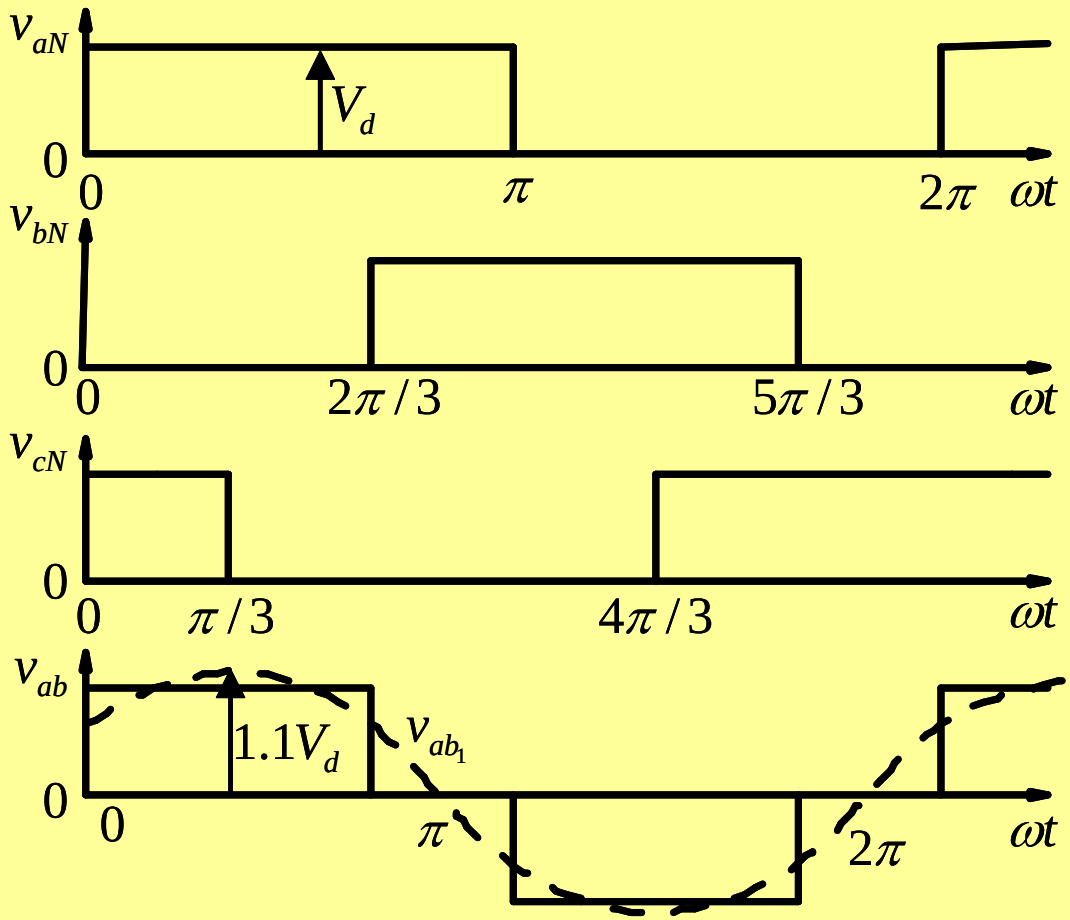
- Six-Step Operation
- Three-Level Inverters
- Bi-Directional Power Flow
- Matrix Converters

© Copyright Ned Mohan 2010



© Copyright Ned Mohan 2010

Square-Wave (Six-Step) Operation



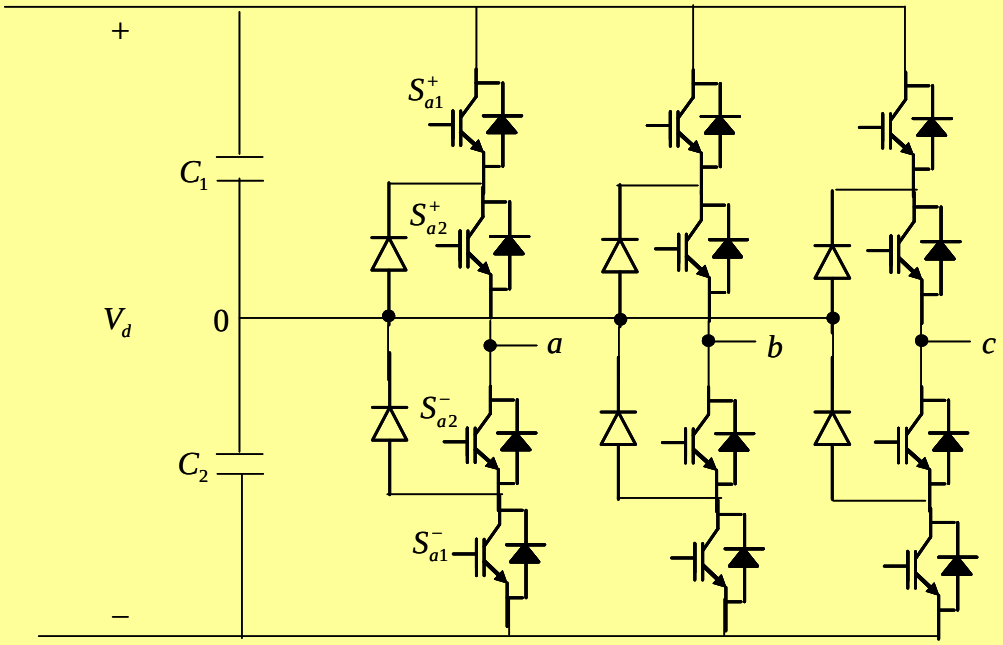
$$\hat{V}_{ph_1} = \frac{4}{\pi}\left(\frac{V_d}{2}\right) = 0.637V_d$$

$$\hat{V}_{LL_1} = \sqrt{3}\hat{V}_{ph_1} = \frac{2\sqrt{3}}{\pi}V_d \simeq 1.1V_d$$

$$\hat{V}_{LL_h} = \frac{\hat{V}_{LL_1}}{h} = \frac{1.1}{h}V_d$$

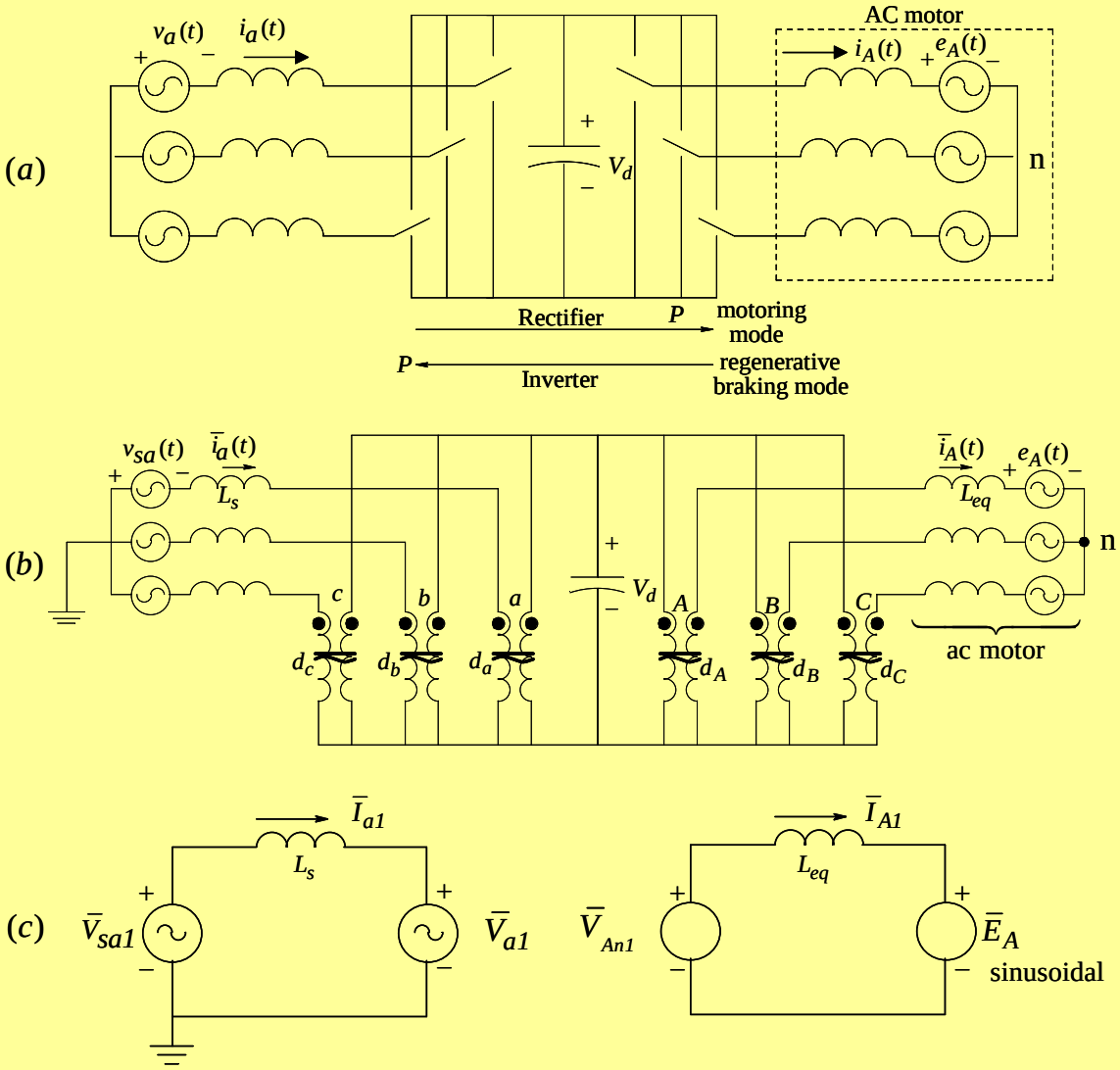
© Copyright Ned Mohan 2010

Three-Level Inverters:



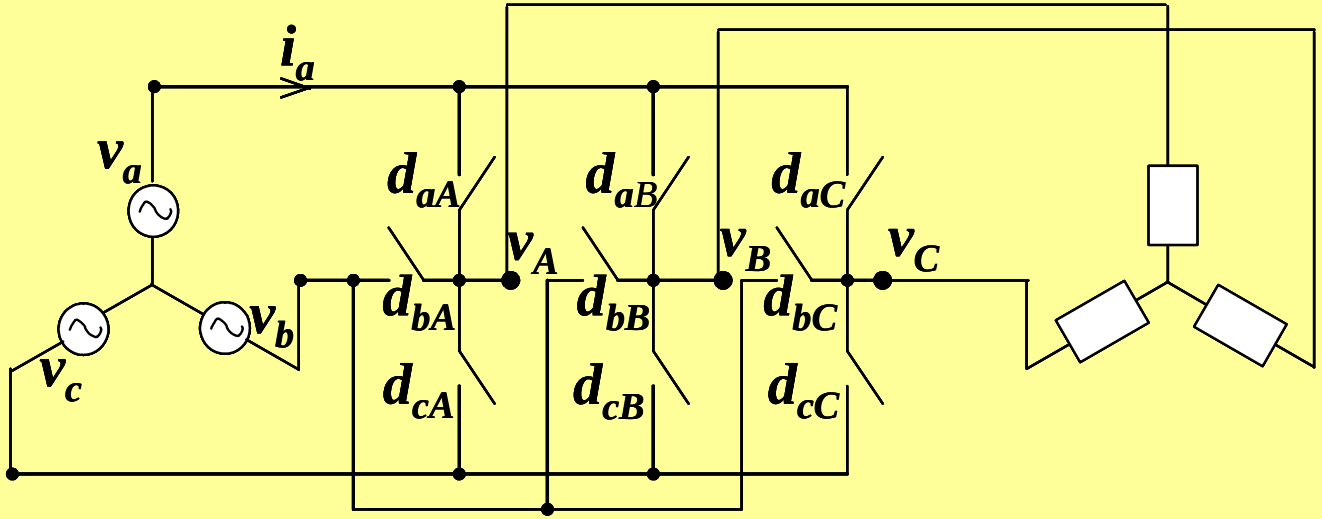
© Copyright Ned Mohan 2010

VOLTAGE-LINK STRUCTURE WITH BI-DIRECTIONAL POWER FLOW

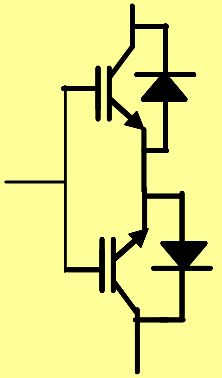


© Copyright Ned Mohan 2010

Matrix Converters



(*a*)



(*b*)

$$\begin{bmatrix} v_A \\ v_B \\ v_C \end{bmatrix} = \begin{bmatrix} d_{aA} & d_{bA} & d_{cA} \\ d_{aB} & d_{bB} & d_{cB} \\ d_{aC} & d_{bC} & d_{cC} \end{bmatrix} \begin{bmatrix} v_a \\ v_b \\ v_c \end{bmatrix}$$

$$\begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} = \begin{bmatrix} d_{aA} & d_{aB} & d_{aC} \\ d_{bA} & d_{bB} & d_{bC} \\ d_{cA} & d_{cB} & d_{cC} \end{bmatrix} \begin{bmatrix} i_A \\ i_B \\ i_C \end{bmatrix}$$

© Copyright Ned Mohan 2010

Summary

Ancillary Topics in Switch-Mode Inverters

- Six-Step Operation
- Three-Level Inverters
- Bi-Directional Power Flow
- Matrix Converters

© Copyright Ned Mohan 2010