



Three-phase Rectifiers

Lecture 11

Electrical Engineering Department
Power Electronics and Special Machine

By

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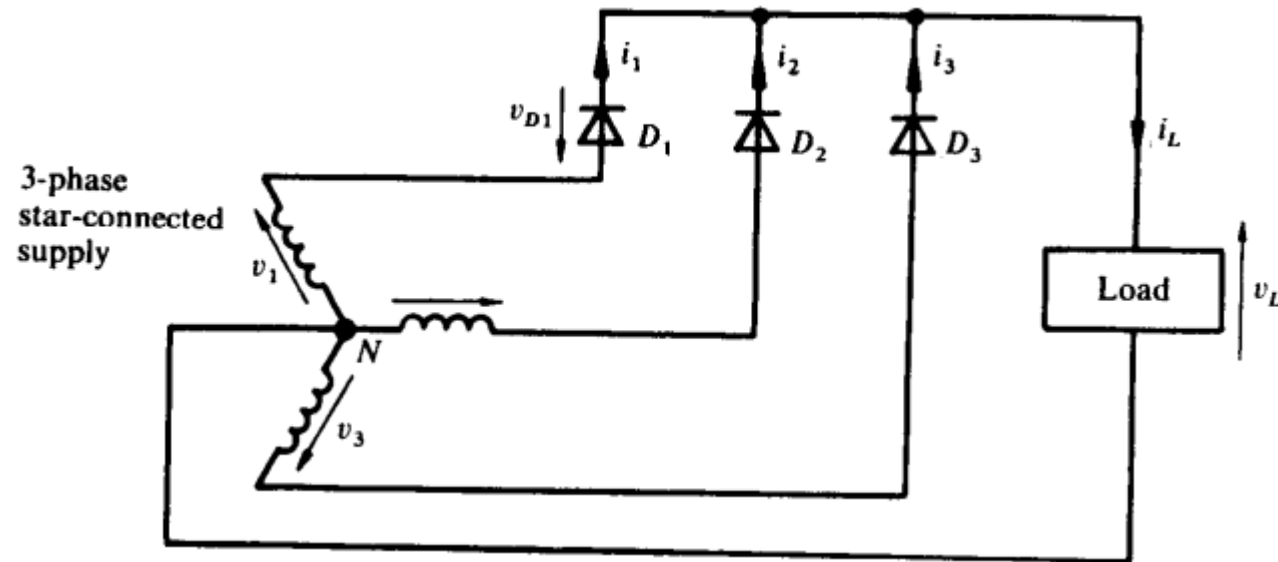
Important Notice

Note to Students:

These lecture materials are provided as supplementary support to help clarify and reinforce the concepts discussed in the main course lectures. They are not a substitute for the official course materials or the primary references assigned. Students are encouraged to refer to the original sources and attend the main lectures to ensure full understanding of the subject.

Uncontrolled Three-phase Half-wave Rectifier (or Single-way)

The circuit of three-phase half-wave rectifier feeding load is shown below



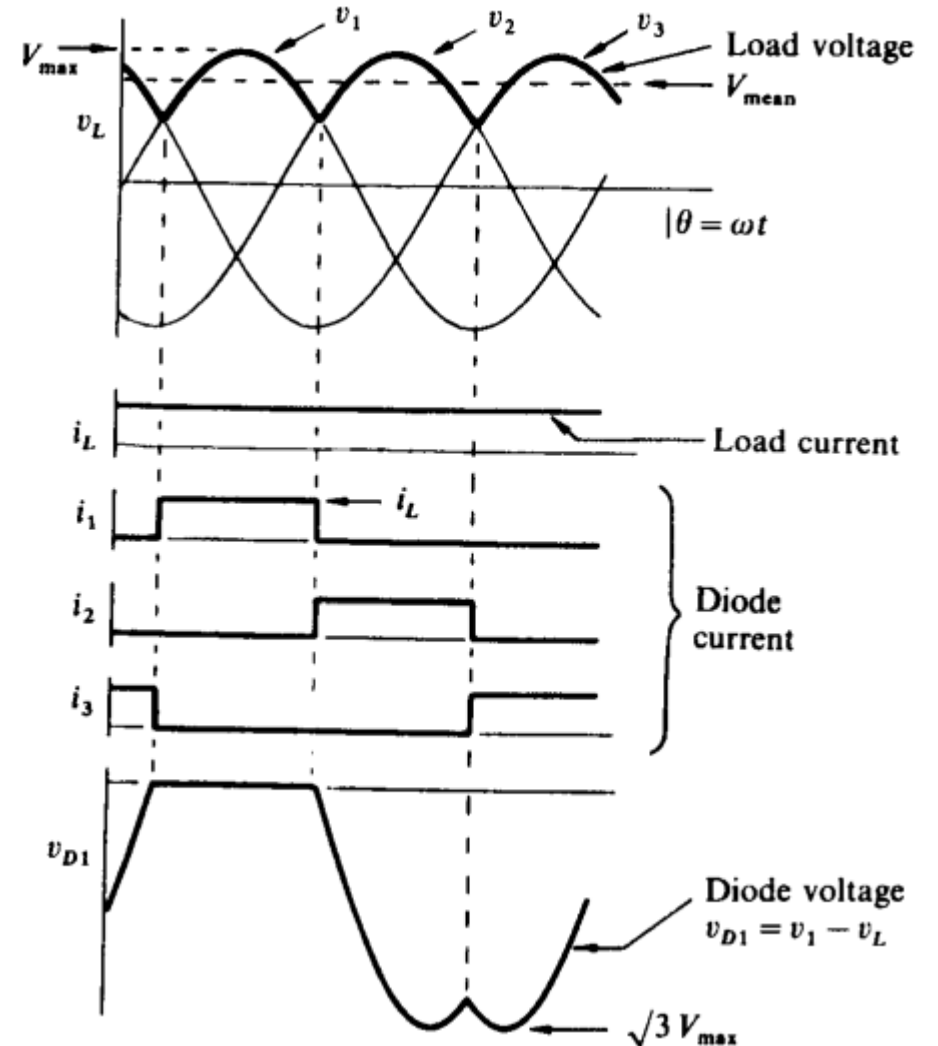
Uncontrolled Three-phase Half-wave Rectifier (or Single-way)

The waveforms of three-phase half-wave rectifier feeding load is shown:

The mean load voltage is

$$V_{mean} = \frac{1}{2\pi/3} \int_{\pi/6}^{\pi/2} V_m \sin(\omega t) d\omega t$$

$$V_{mean} = \frac{3\sqrt{3} V_m}{2\pi}$$

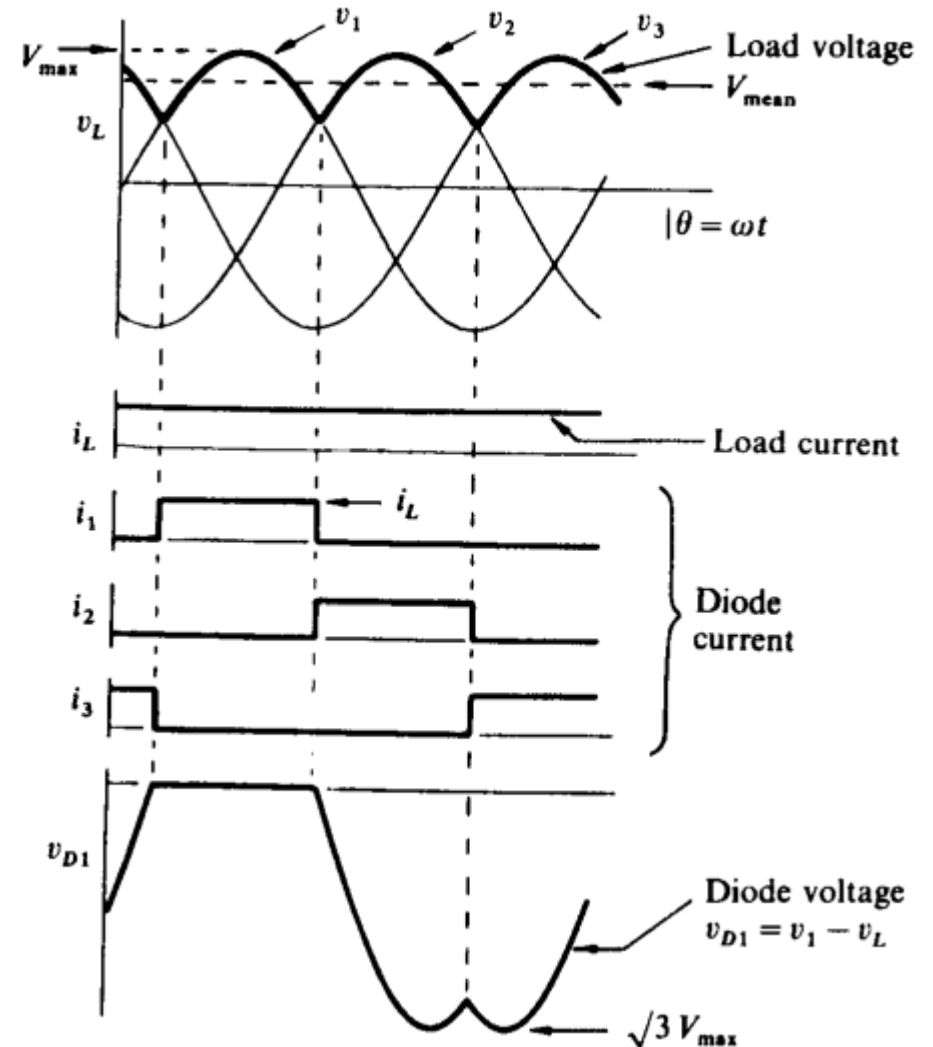


Uncontrolled Three-phase Half-wave Rectifier (or Single-way)

The RMS value of the diode current rating is as follows:

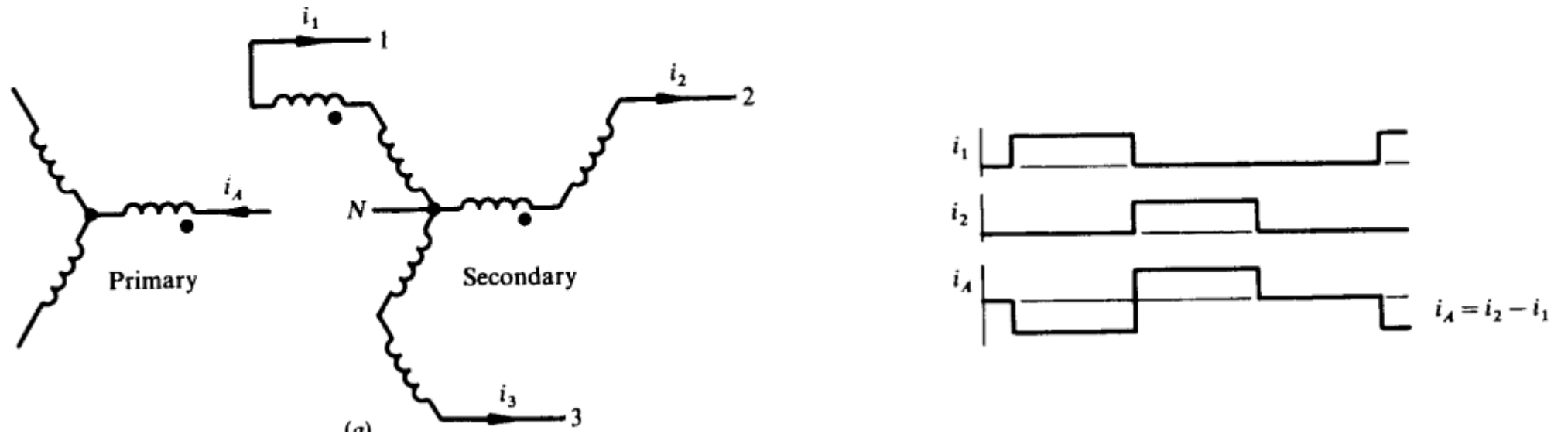
$$I_{rms} = \sqrt{\left(\frac{I_L^2 + 0^2 + 0^2}{3}\right)} = \frac{I_L}{\sqrt{3}}$$

While the peak reverse voltage of each diode is equal to $\sqrt{3} V_m$



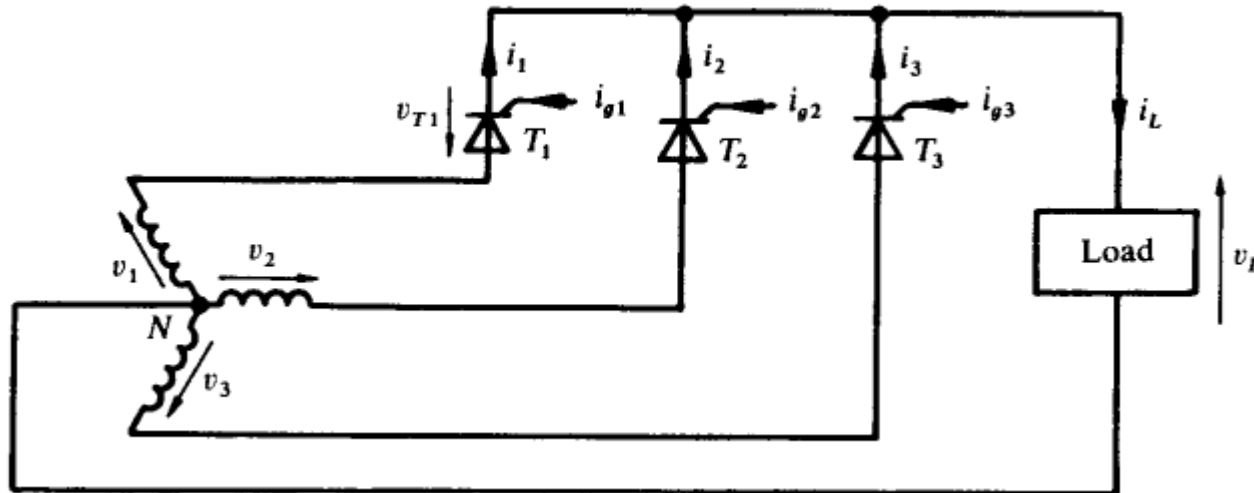
Uncontrolled Three-phase Half-wave Rectifier (or Single-way)

The unidirectional current in the star connection will cause DC magnetization to the transformer core and increases the iron losses. To avoid this, an interconnection-star (Zig-Zag) is used to remove any DC component MMF in the core



Controlled Three-phase Half-wave Rectifier

The circuit of controlled three-phase half-wave rectifier feeding load is shown below



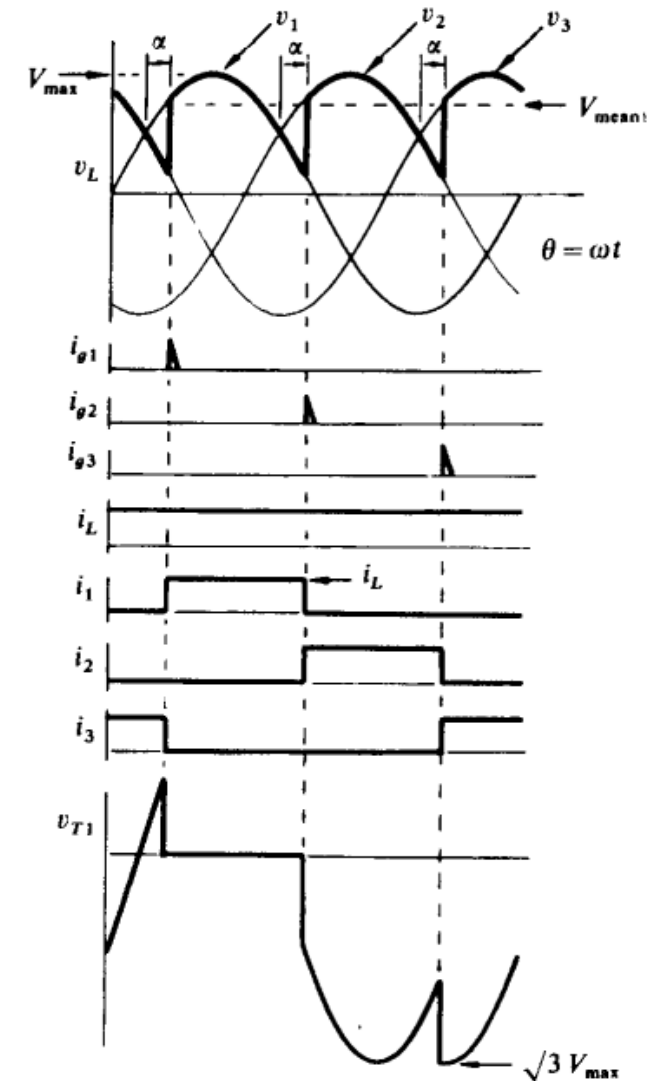
Controlled Three-phase Half-wave Rectifier

The waveforms of three-phase half-wave rectifier feeding load is shown:

The mean load voltage is

$$V_{mean} = \frac{1}{2\pi/3} \int_{\frac{\pi}{6} + \alpha}^{\frac{5\pi}{6} + \alpha} V_m \sin(\omega t) d\omega t$$

$$V_{mean} = \frac{3\sqrt{3} V_m}{2\pi} \cos \alpha$$



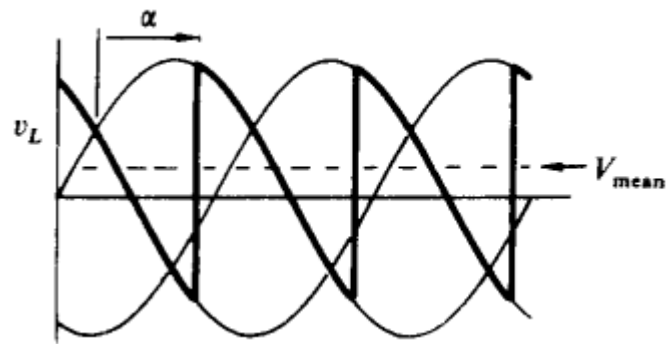
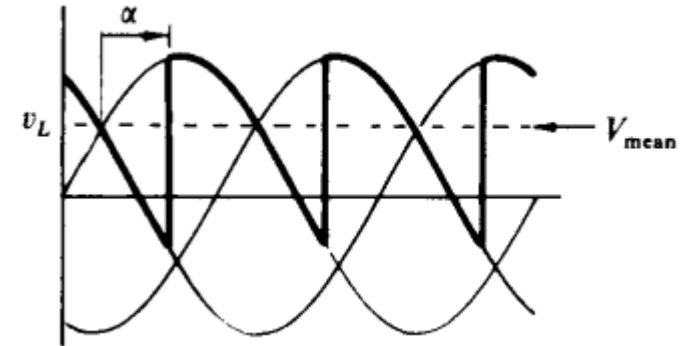
Controlled Three-phase Half-wave Rectifier

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Controlled Three-phase Half-wave Rectifier

Example: A three-phase half-wave controlled rectifier is supplied from a 150 V/phase, 50 Hz AC source. Determine the mean load voltage for firing delay angles of 0° , 30° , 60° , and 90° assuming each thyristor to have voltage drop of 1.5 V and continuous load current.

Controlled Three-phase Half-wave Rectifier

Solution:

$$V_{mean} = \frac{3\sqrt{3} V_m}{2\pi} \cos \alpha - 1.5$$

α	0°	30°	60°	90°
V_{mean}	173.9 V	150.4 V	86.2 V	0 V

The image shows the exterior of a grand Islamic architectural structure, likely a mosque or palace. The facade is composed of light-colored stone or brick, heavily decorated with intricate geometric and floral patterns. A series of large, pointed arches (iwan) are prominent, with the central one being the largest and most detailed. The arches are filled with complex lattice-like designs. The building extends into the distance, showing a repetitive pattern of smaller arches. The sky is a clear, pale blue. Overlaid on the center of the image is the text "Thanks for listening!" in a bold, white, sans-serif font.

Thanks for listening!