Power electronics lab

# Three phase Uncontrolled rectifier

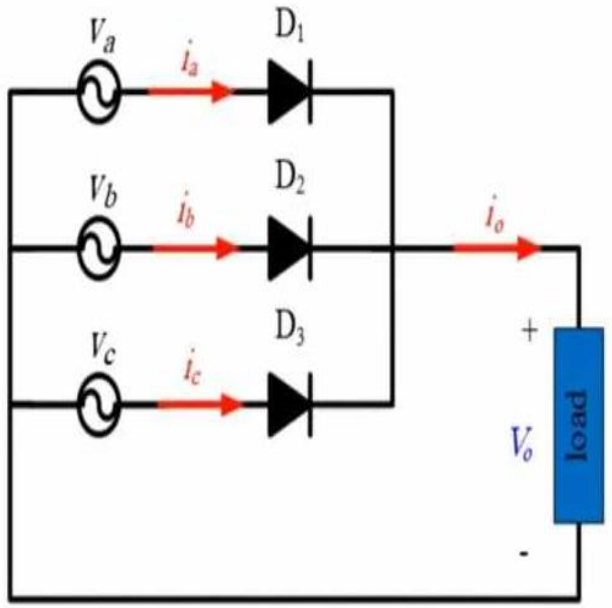
Eng :Eman Abu Hany

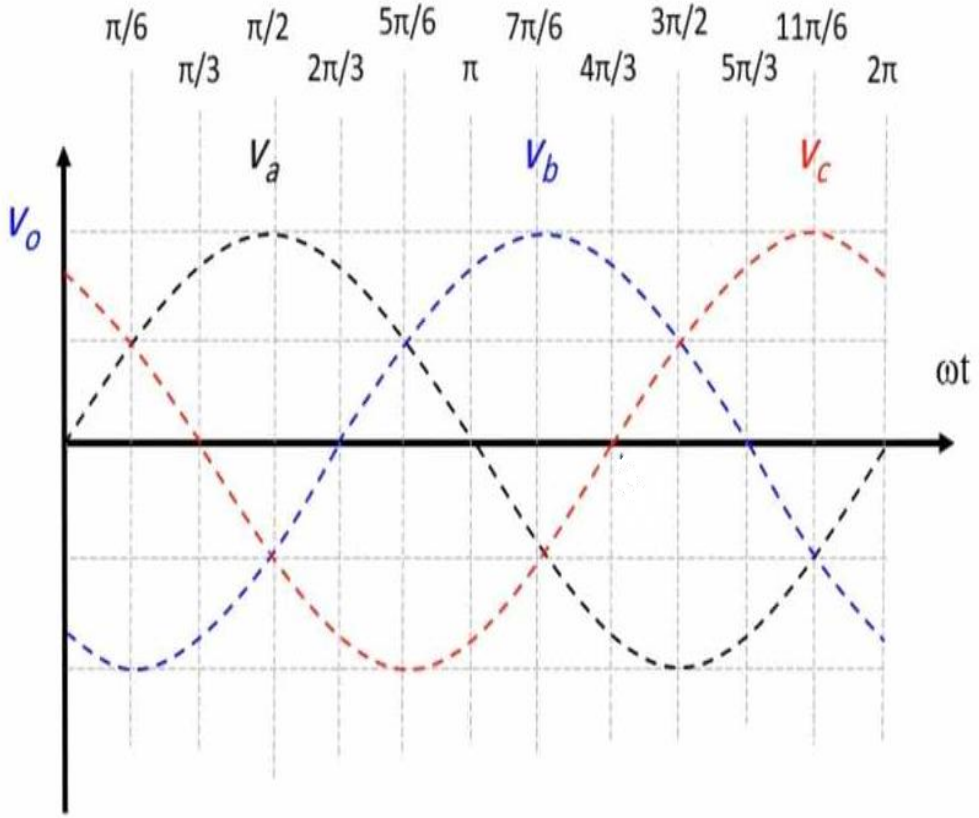
# Three phase uncontrolled rectifier

- 1- the uncontrolled Three - pulse Mid – point circuit M3U

- 2- the uncontrolled Six - pulse Bridge circuit B6U

# Three-phase Half-wave Uncontrolled Rectifier



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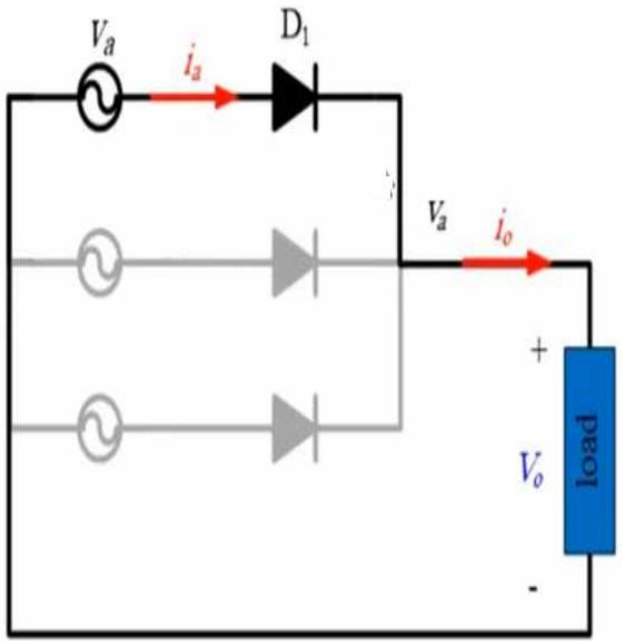
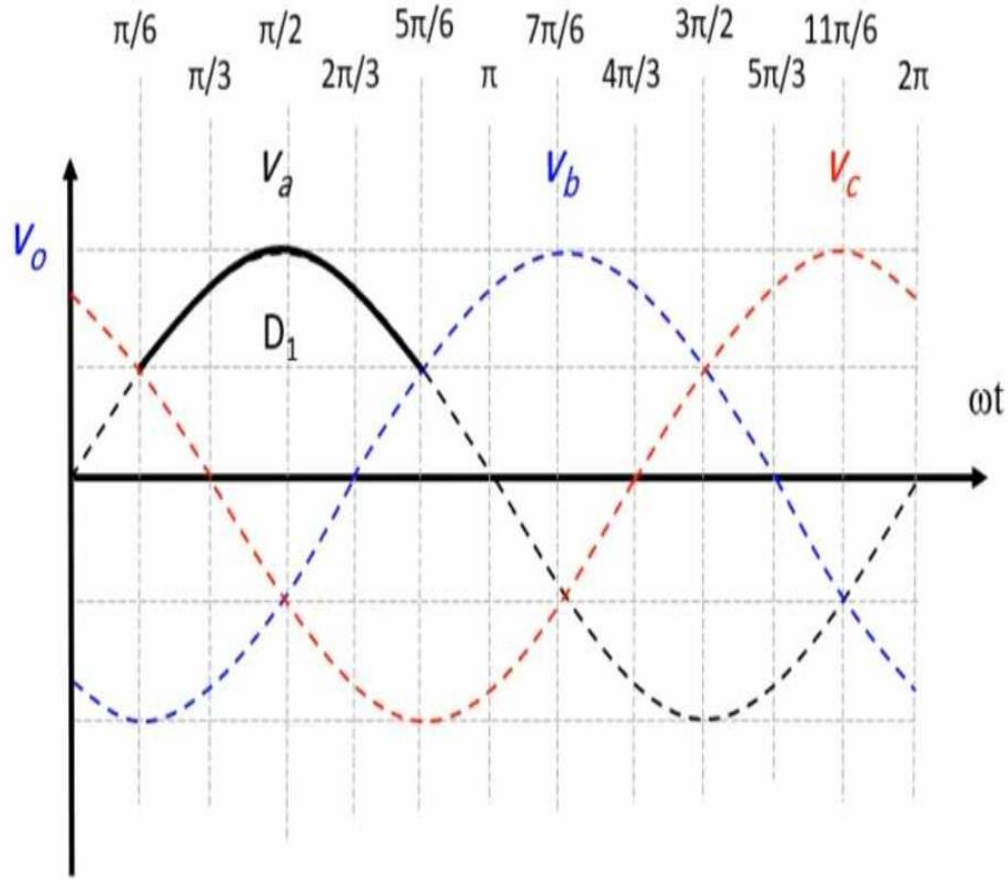



$\pi/6 \le \omega t \le 5\pi/6$



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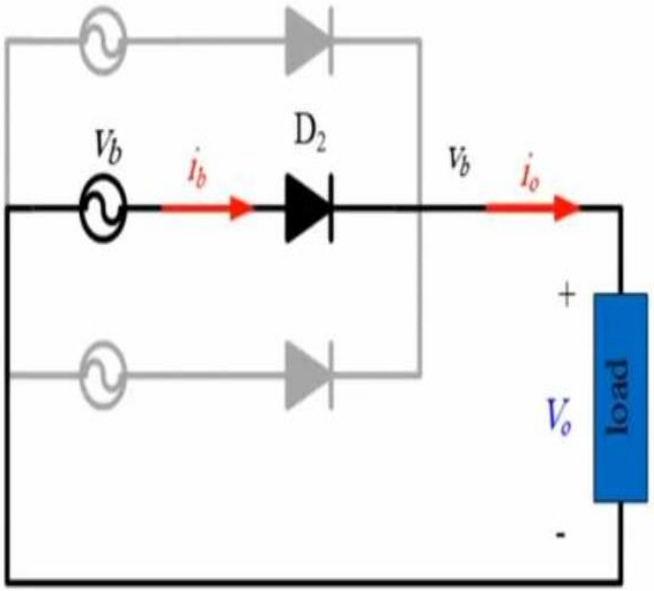
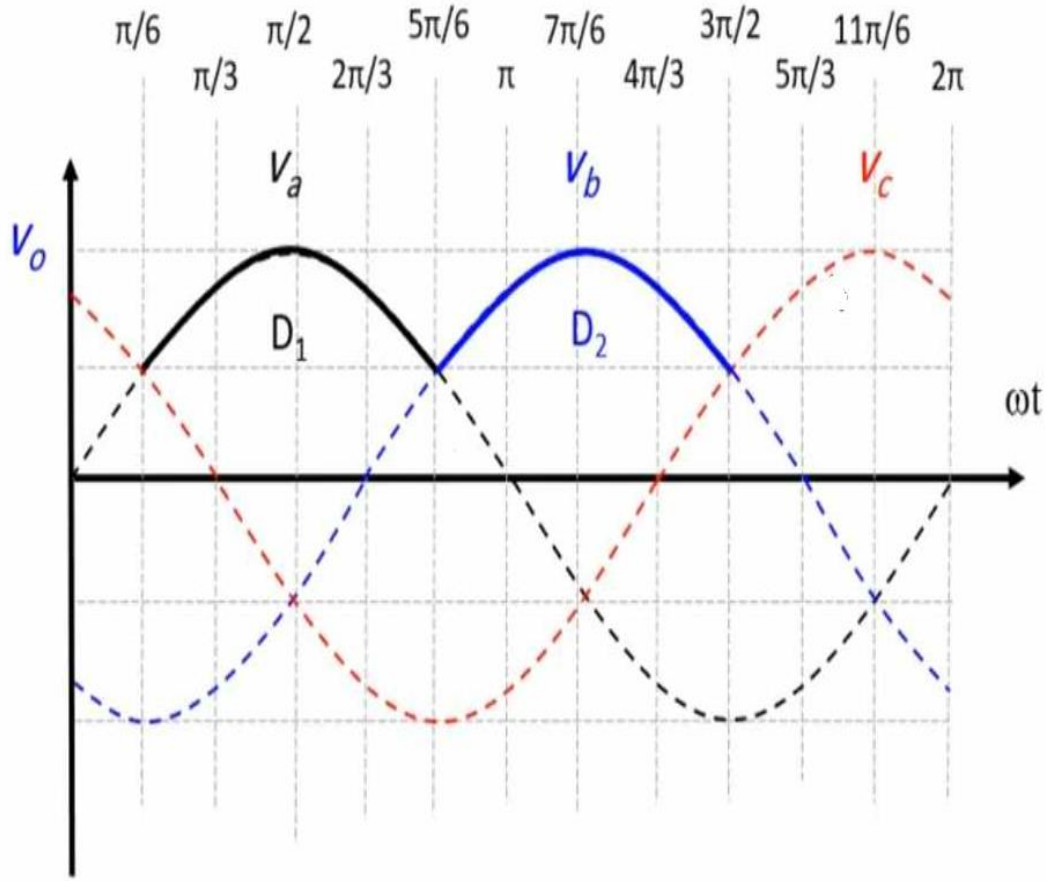



$5\pi/6 \leq \omega t \leq 3\pi/2$



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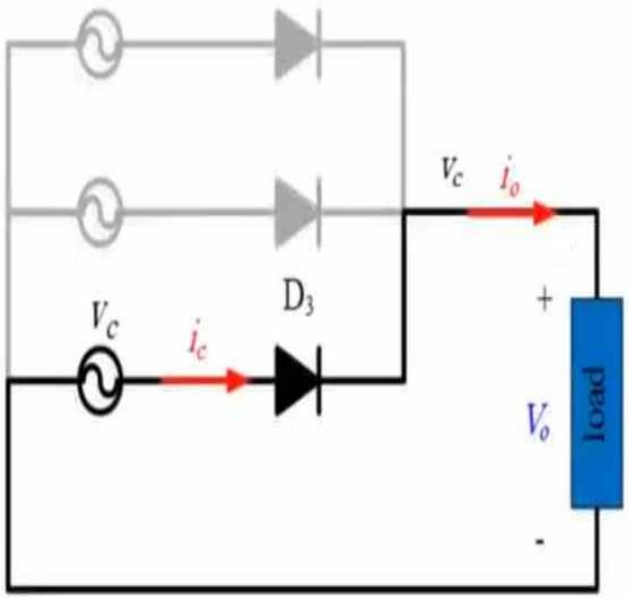
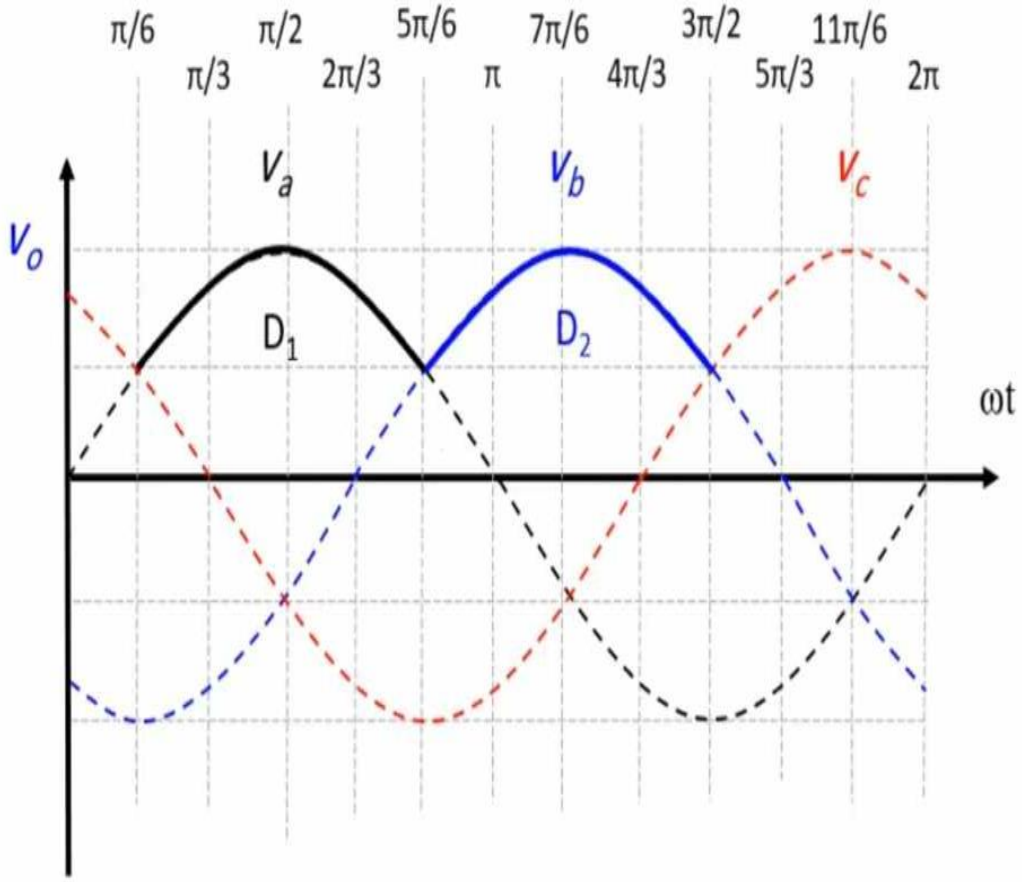



$$3\frac{\pi}{2} \le \omega t \le 2\pi + \pi/6$$



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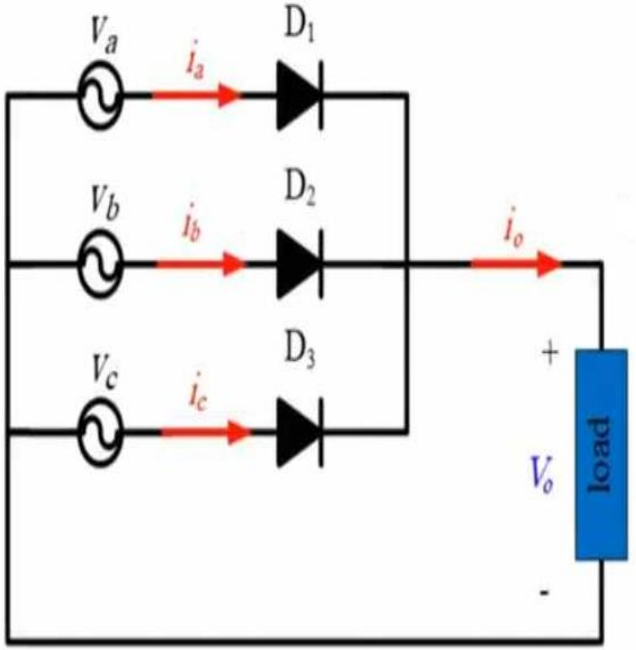
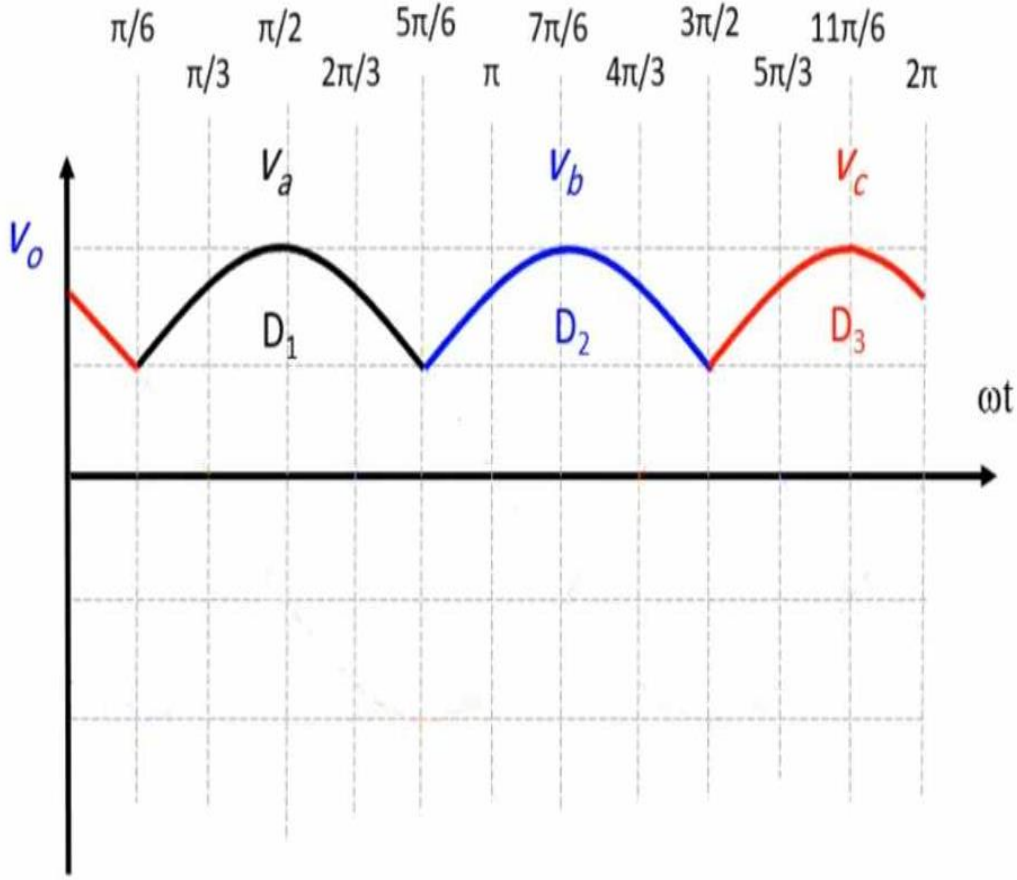
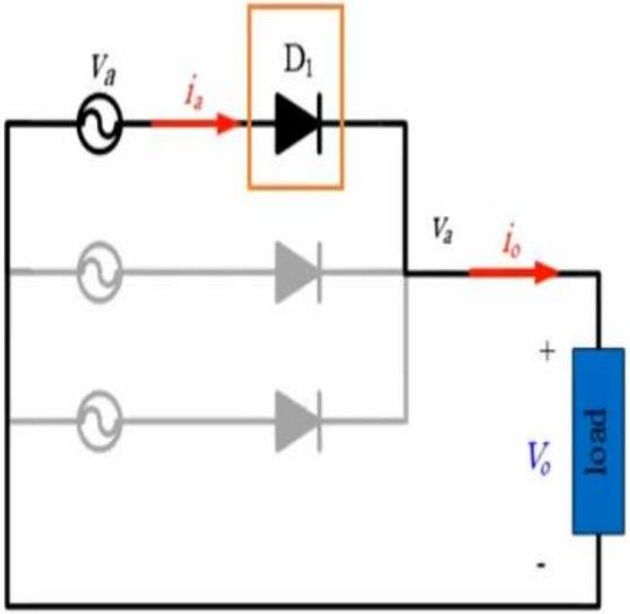
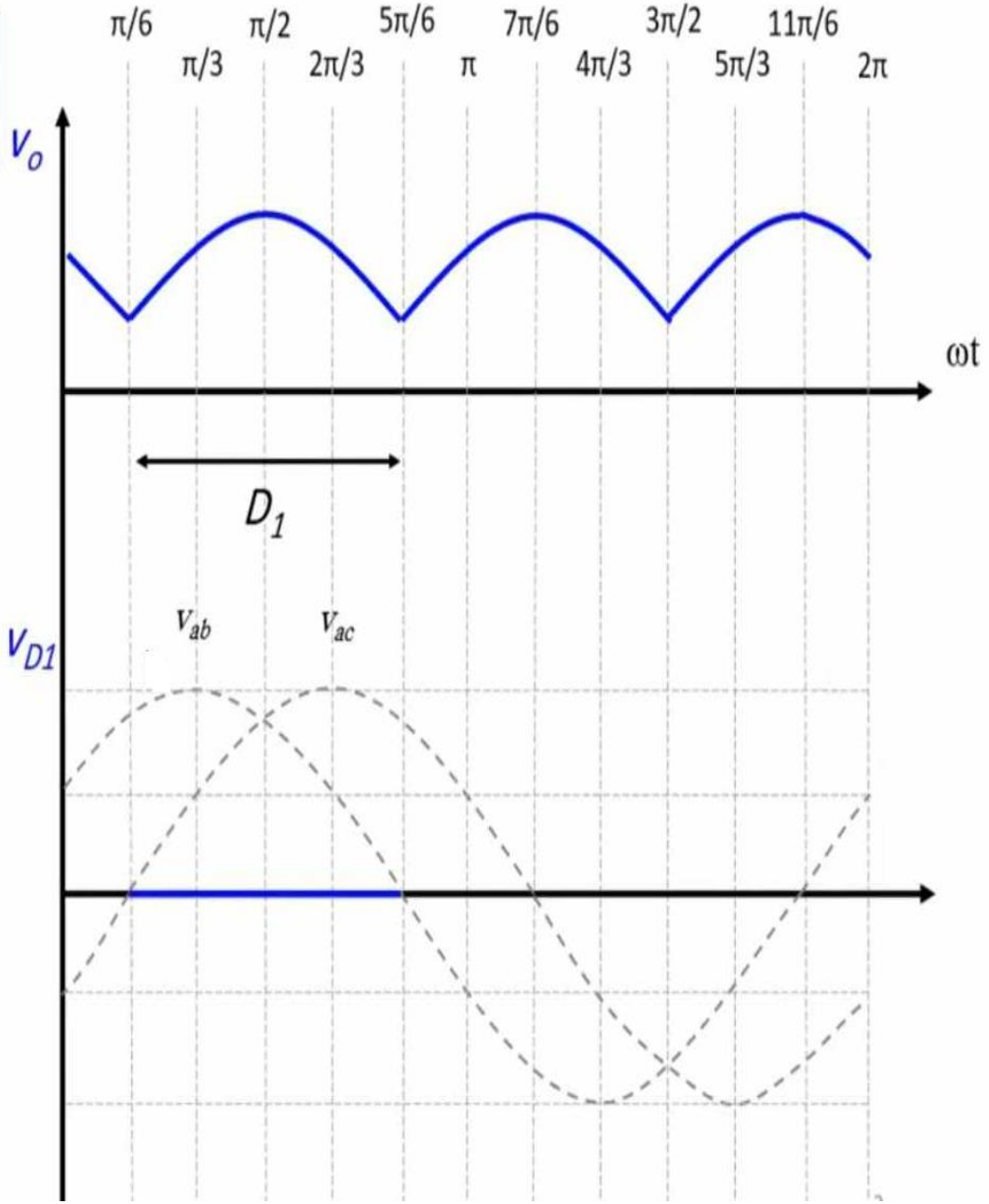


# Diode Voltage



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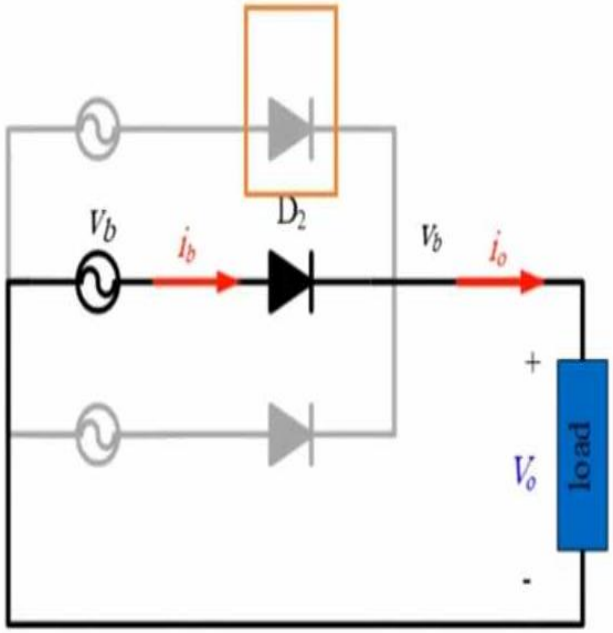


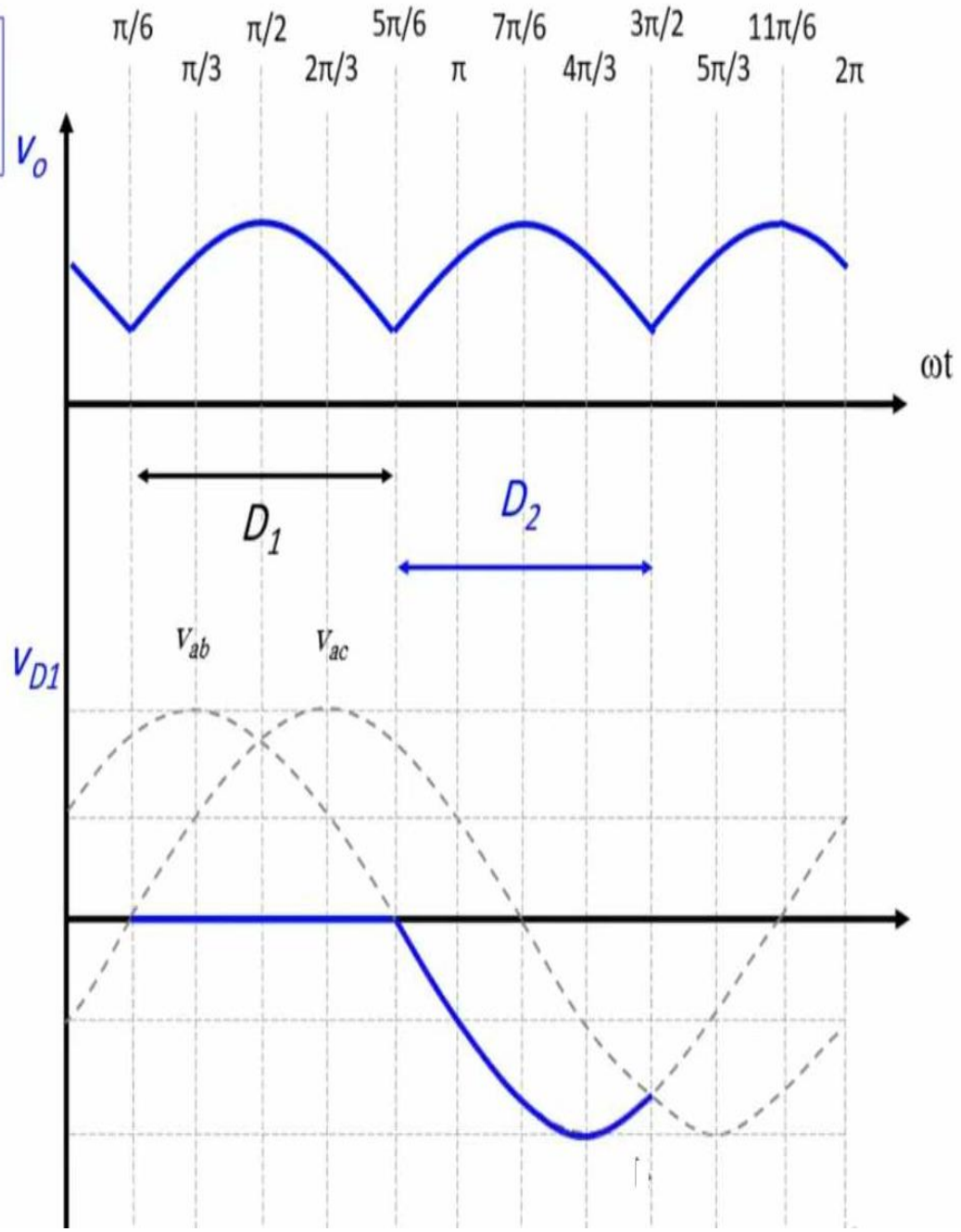

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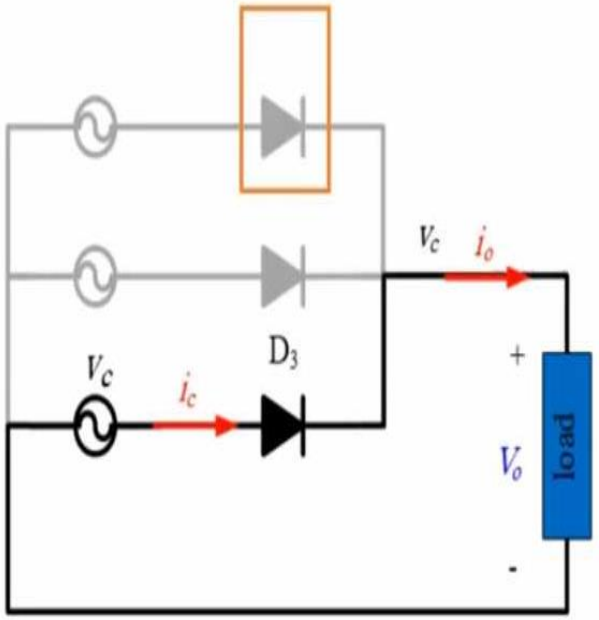


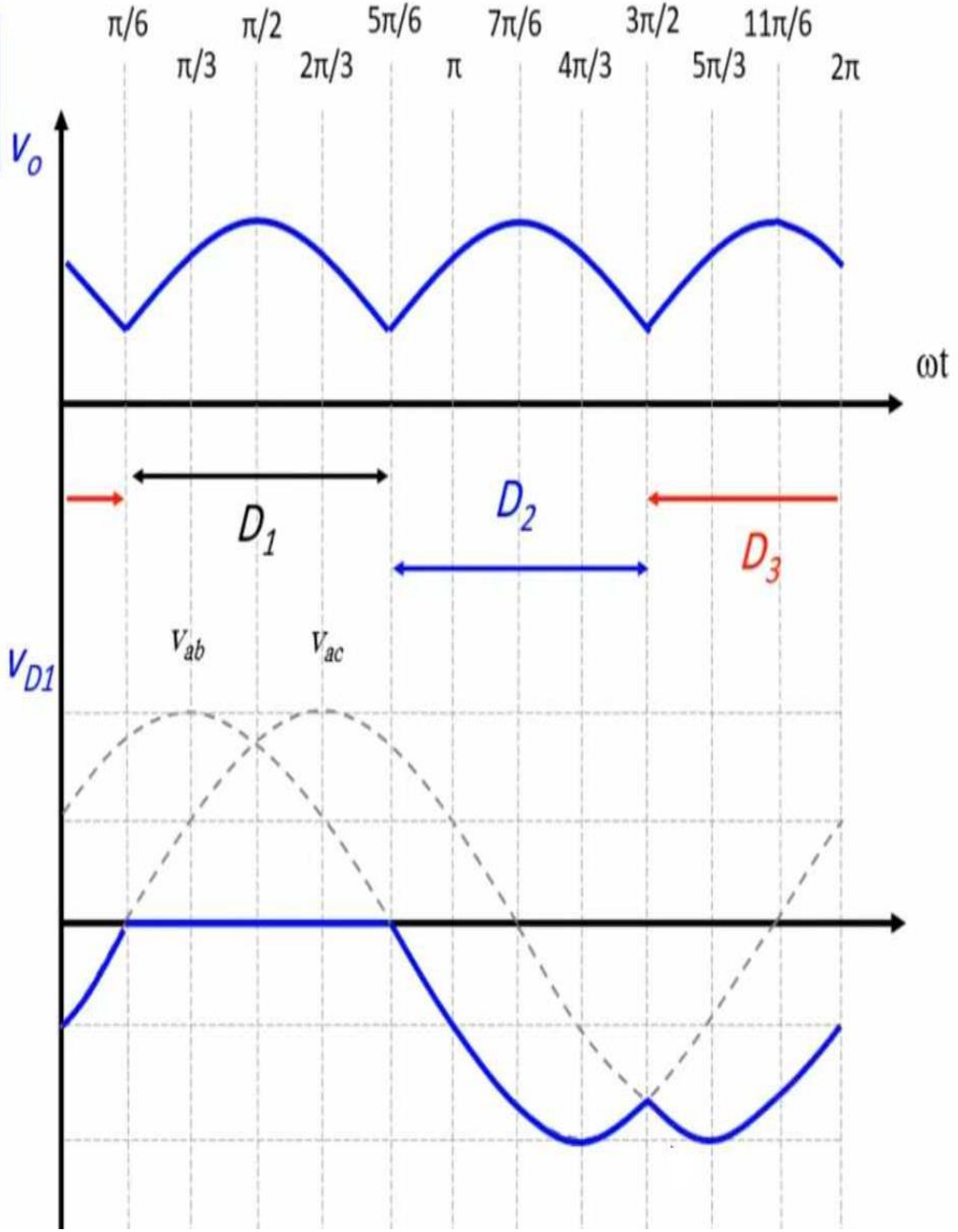

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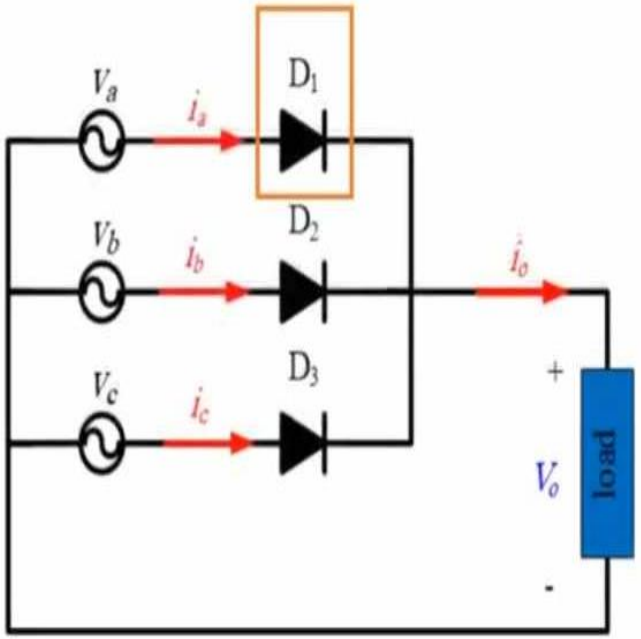
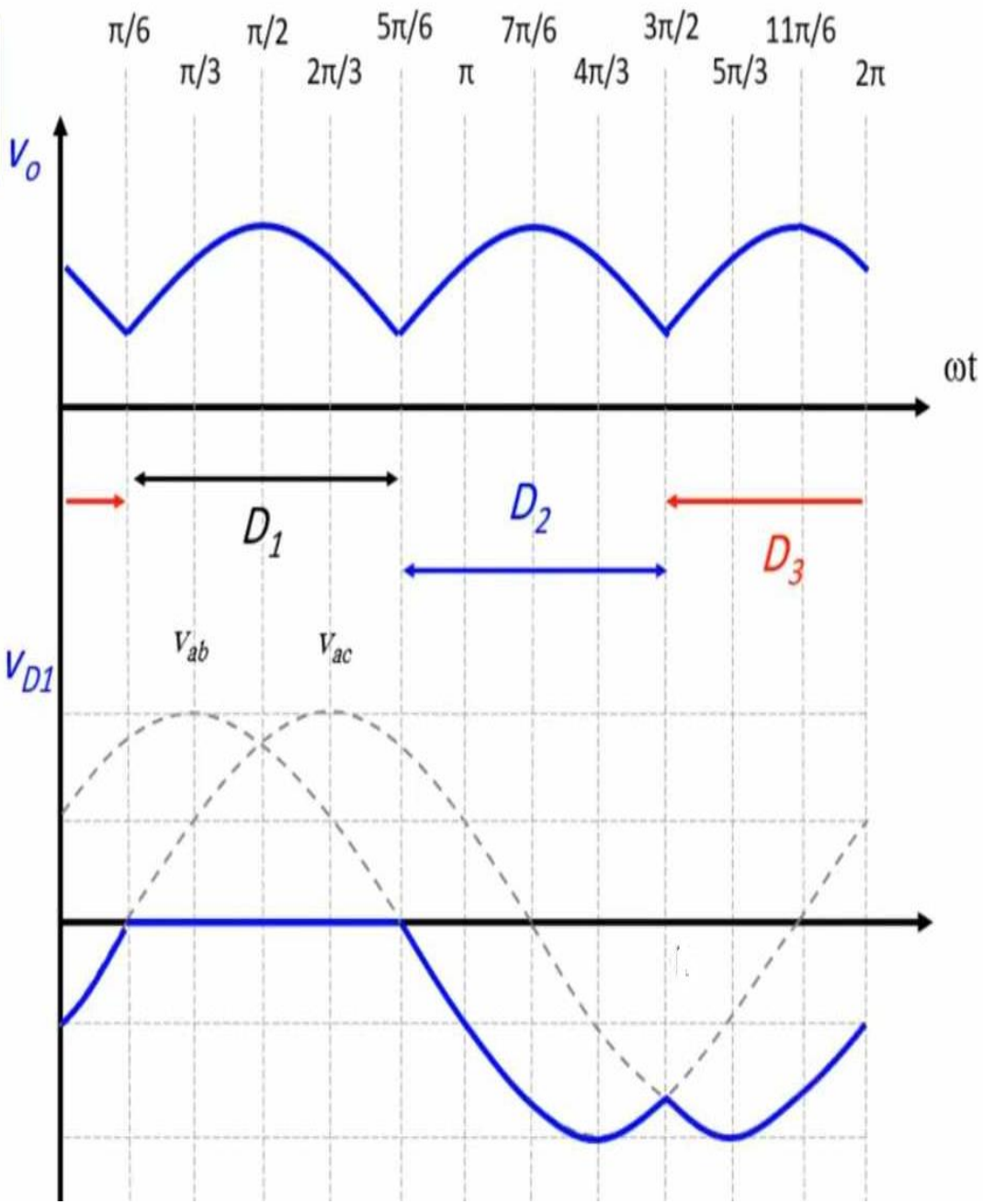
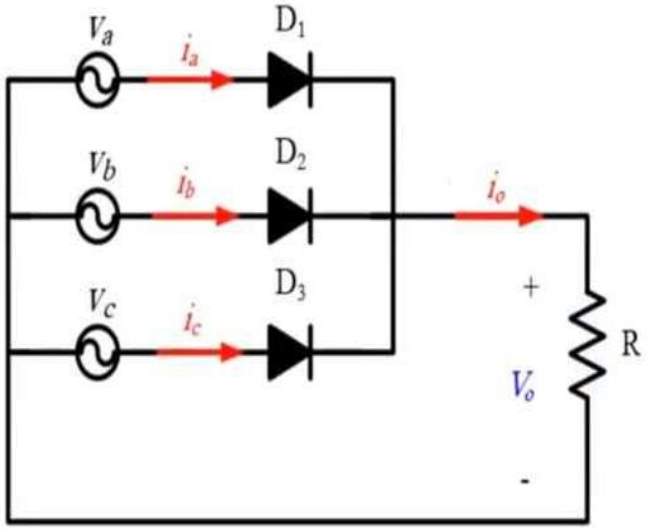
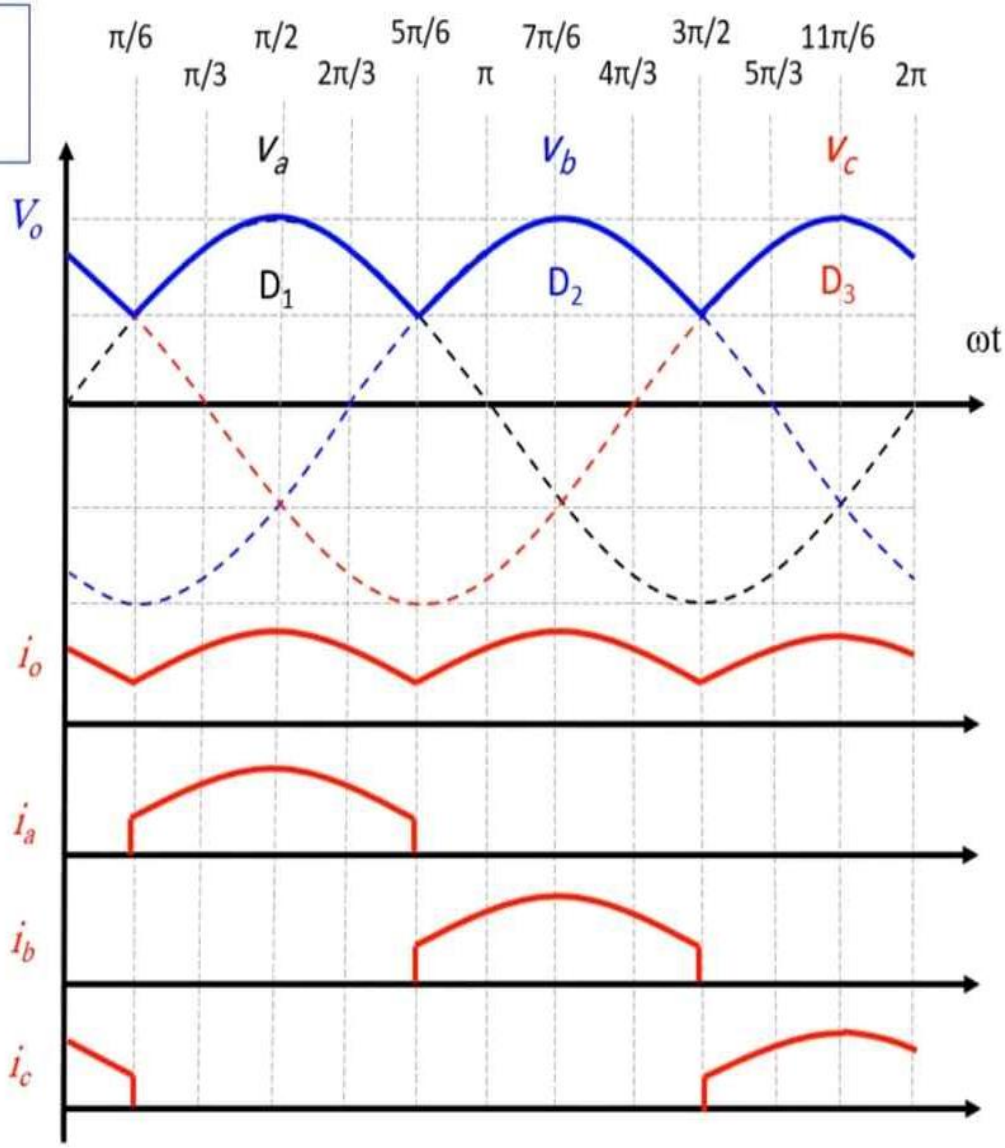


# Three-phase Half-wave Uncontrolled Rectifier

R load



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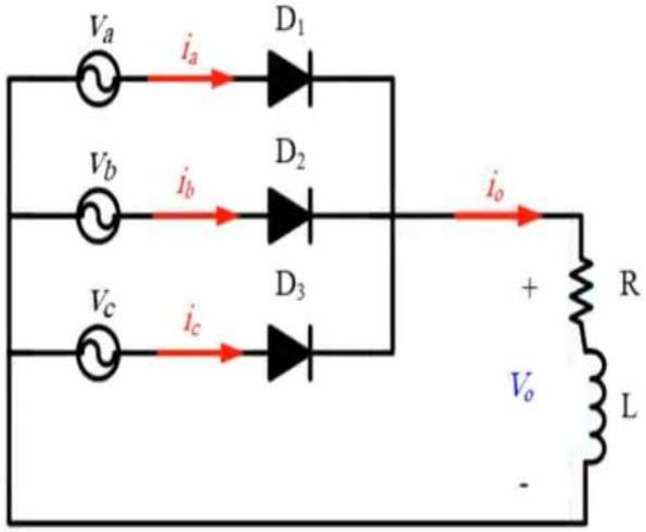
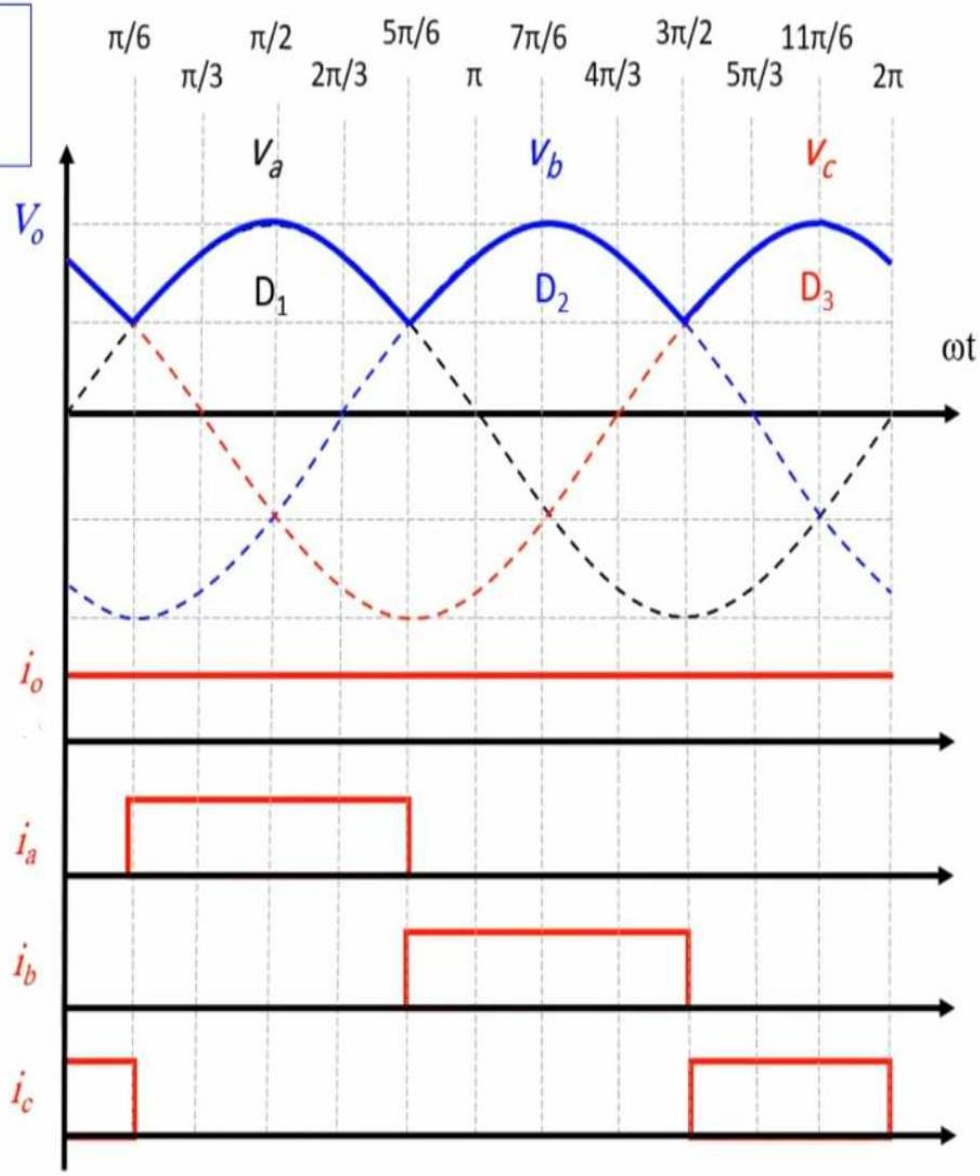


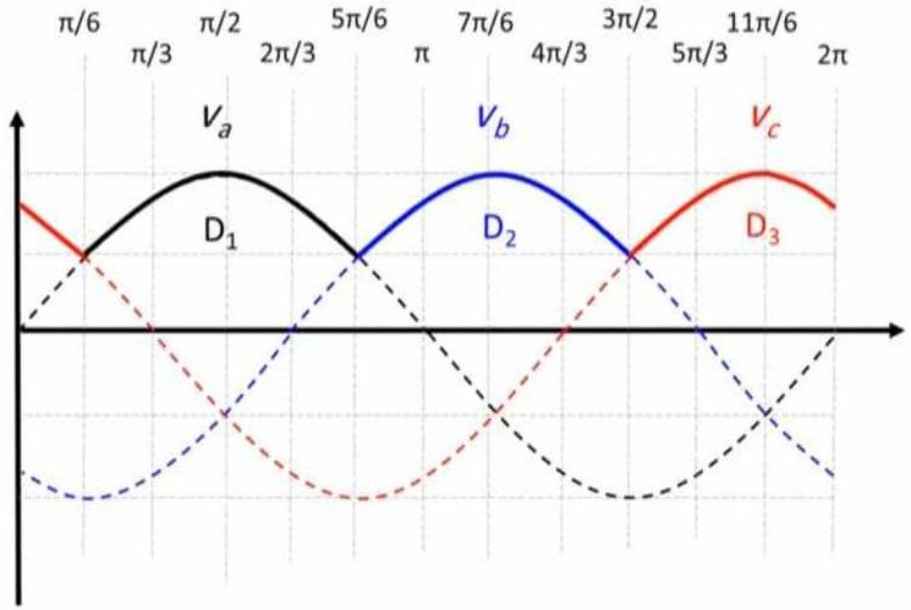



# Output voltage and output current

RL load

The average output voltage

$$v_{o,avg} = \frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} V_m \sin(\omega t)\, d\omega t = \frac{3\sqrt{3}V_m}{2\pi}$$




The average output current

$$I_{o,avg} = \frac{V_{o,avg}}{R} = \frac{3\sqrt{3}V_m}{2\pi R} = I_{o,rms}$$

The rms output voltage

$$v_{o,rms} = \sqrt{\frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} \left(V_m \sin(\omega t)\right)^2 d\omega t} = \sqrt{3}V_m\sqrt{\frac{1}{6}+\frac{\sqrt{3}}{8\pi}}$$

# Supply and Diode Current

RL load

The average supply/Diode current

$$I_{s,avg} = I_{D,avg} = \frac{I_{o,avg}}{3}$$

The rms supply/Diode current

$$I_{s,rms} = I_{D,rms} = \frac{I_{o,rms}}{\sqrt{3}}$$

# Output power and Power factor

The output power

$$P_o = I_{o,rms}^2 R$$

The apparent power

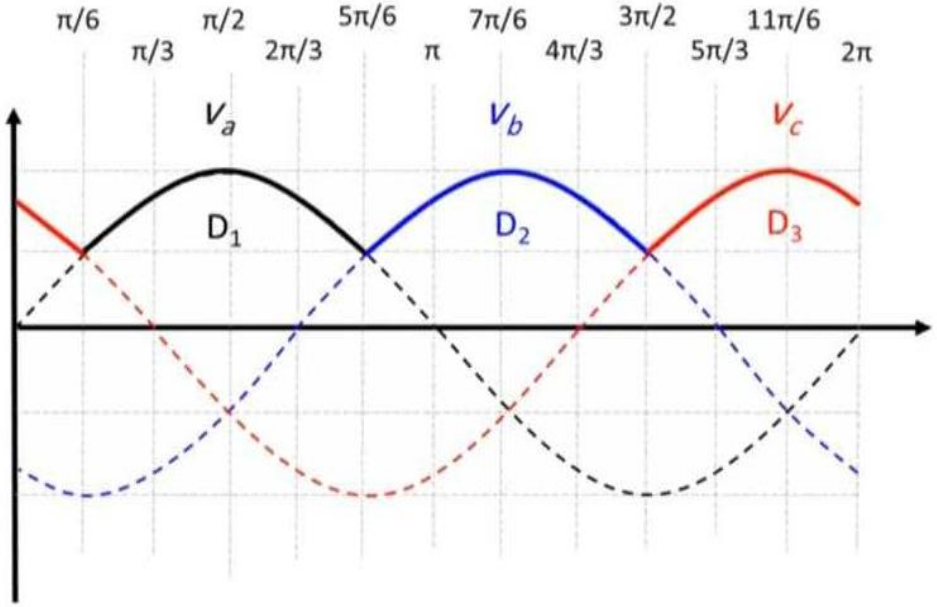
$$S = 3V_{s,rms(phase)} I_{s,rms}$$

The supply power factor

$$pf = \frac{P_o}{S}$$

# Output voltage and output current

R load

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The rms output current

$$I_{o,rms} = \frac{V_{o,rms}}{R}$$

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