# Dual Converter (AC-DC)

Introduction

- It is an electronic converter or circuit which comprises of two converter.

- One will perform as rectifier and the other will perform as inverter

- Therefore, we can say that double process will occur at a moment.

- Here, two full converters are arranged in anti-parallel pattern and linked to the same DC load

Supply Voltage

Converter-1

L O A D

Converter-2

Firing Pulse
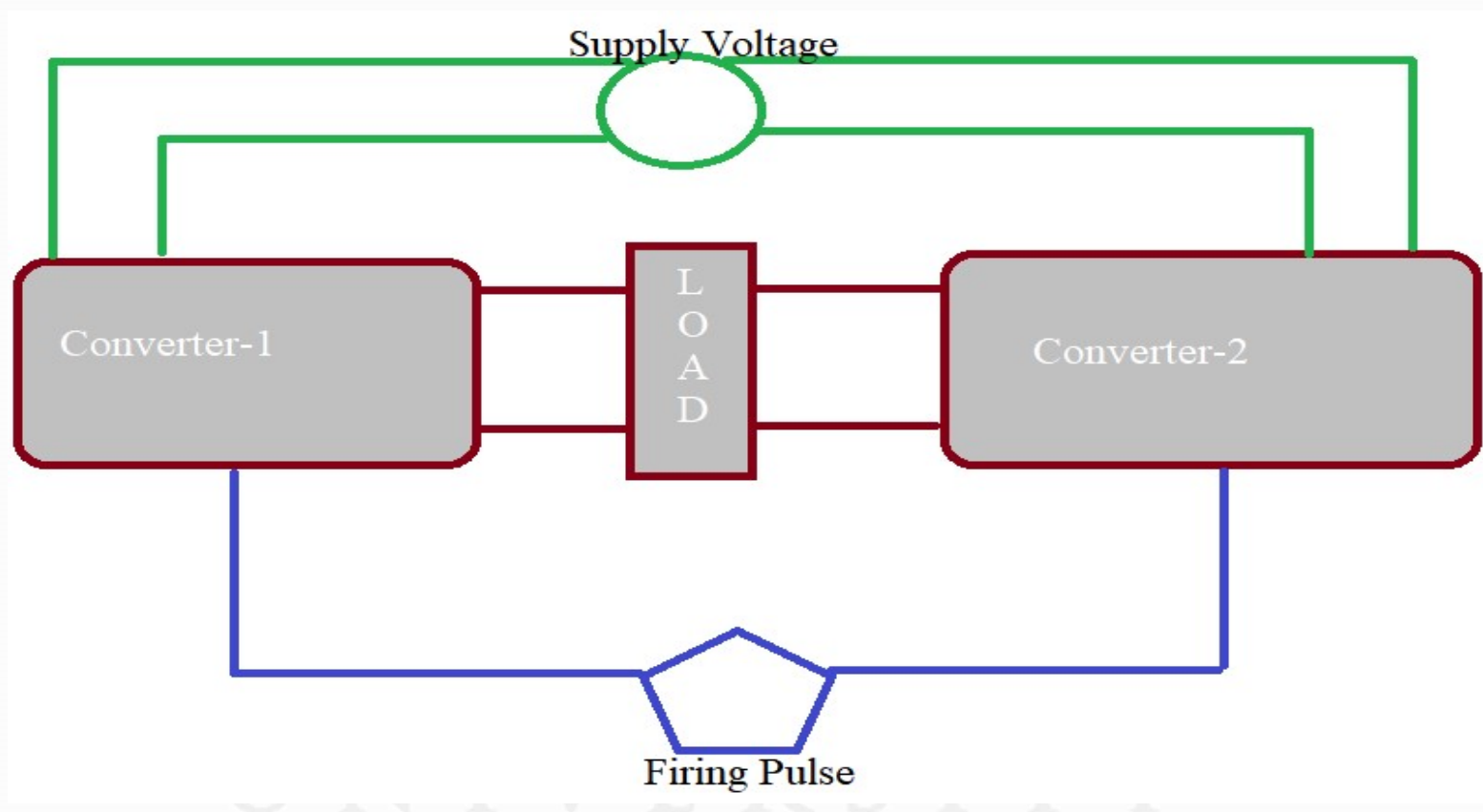
Modes of Operation

There are two functional modes:

　　　1. Non-Circulating Current Mode

　　　2. Circulating Current Mode

Non Circulating Current Mode

➢ One converter will perform at a time. So there is no circulating current between the converters.

➢ During the converter 1 operation, firing angle (α_1) will be $0<\alpha_1< 90^o$; V_{dc} and I_{dc} are positive.

➢ During the converter 2 operation, firing angle (α_2) will be $0<\alpha_2< 90^o$; V_{dc} and I_{dc} are negative.
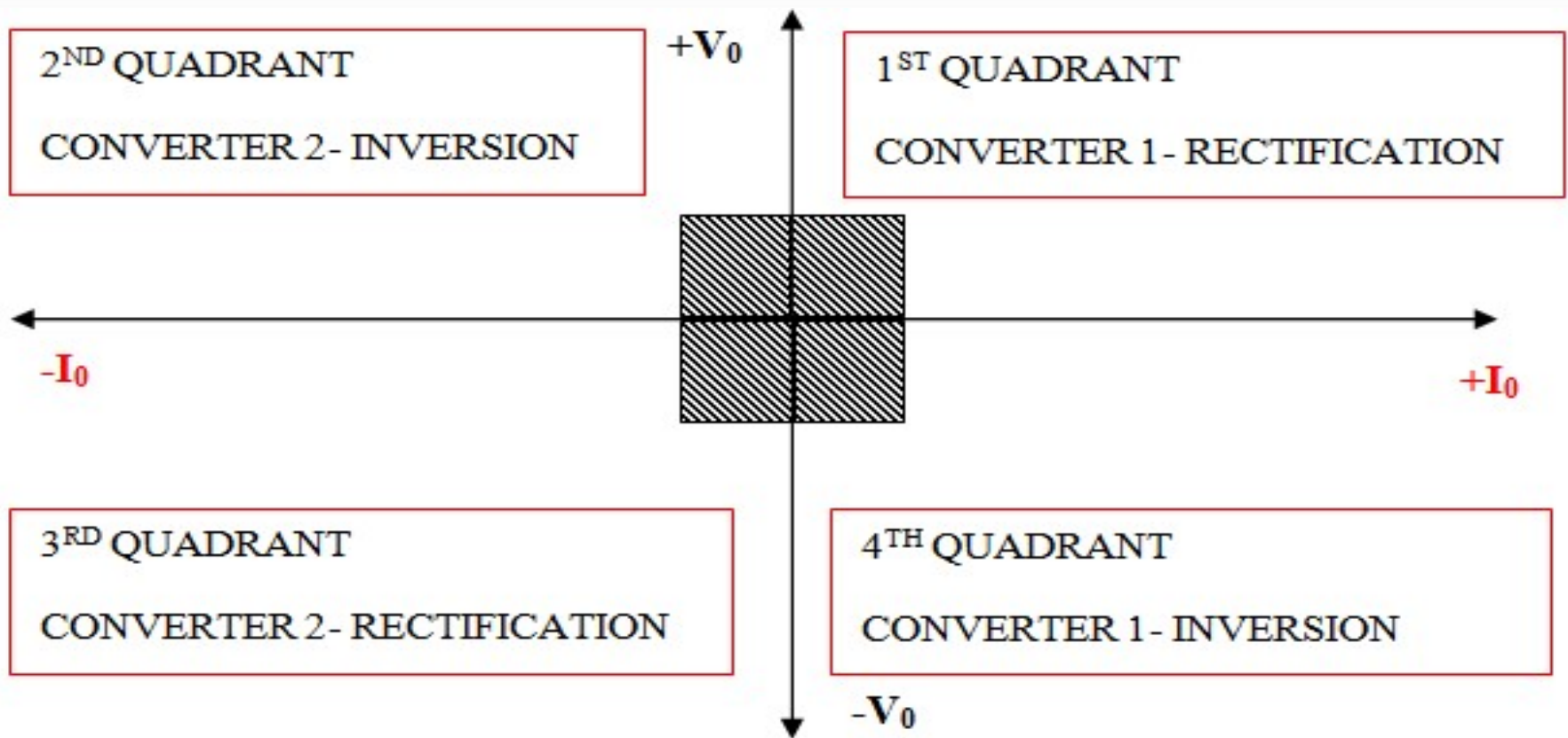
Circulating Current Mode

• Two converters will be in the ON condition at the same time. So circulating current is present.

• The firing angles are adjusted such that firing angle of converter 1 (α_1) + firing angle of converter 2 (α_2) = 180°.

• Converter 1 performs as a controlled rectifier when firing angle be 0<α_1< 90° and Converter 2 performs as an inverter when the firing angle be 90°<α_2< 180°. In this condition, V_{dc} and I_{dc} are positive.

• Converter 1 performs as an inverter when firing angle be 90°<α_1< 180° and Converter 2 performs as a controlled rectifier when the firing angle be 0<α_2< 90° In this condition, V_{dc} and I_{dc} are negative.

2ND QUADRANT	1ST QUADRANT
CONVERTER 2 - INVERSION	CONVERTER 1 - RECTIFICATION

$+V_0$

$-I_0$ $+I_0$

| 3RD QUADRANT	4TH QUADRANT
CONVERTER 2 - RECTIFICATION	CONVERTER 1 - INVERSION

$-V_0$

Ideal Dual Converter

➢ The term 'ideal' refers to the ripple free output voltage. For the purpose of unidirectional flow of DC current, two diodes (D1 and D2) are incorporated between the converters. However, the direction of current can be in any way.

➢ The average output voltage of the converter 1 is V01 and converter 2 is V02.

➢ To make the output voltage of the two converters in same polarity and magnitude, the firing angles of the thyristors have to be controlled.

Converter1

Converter2

D_1 D_2

V_{o1} Load V_{o2}

+

−

α_1 α_2

Firing Angle Control

$$\alpha_1 + \alpha_2 = 180°$$
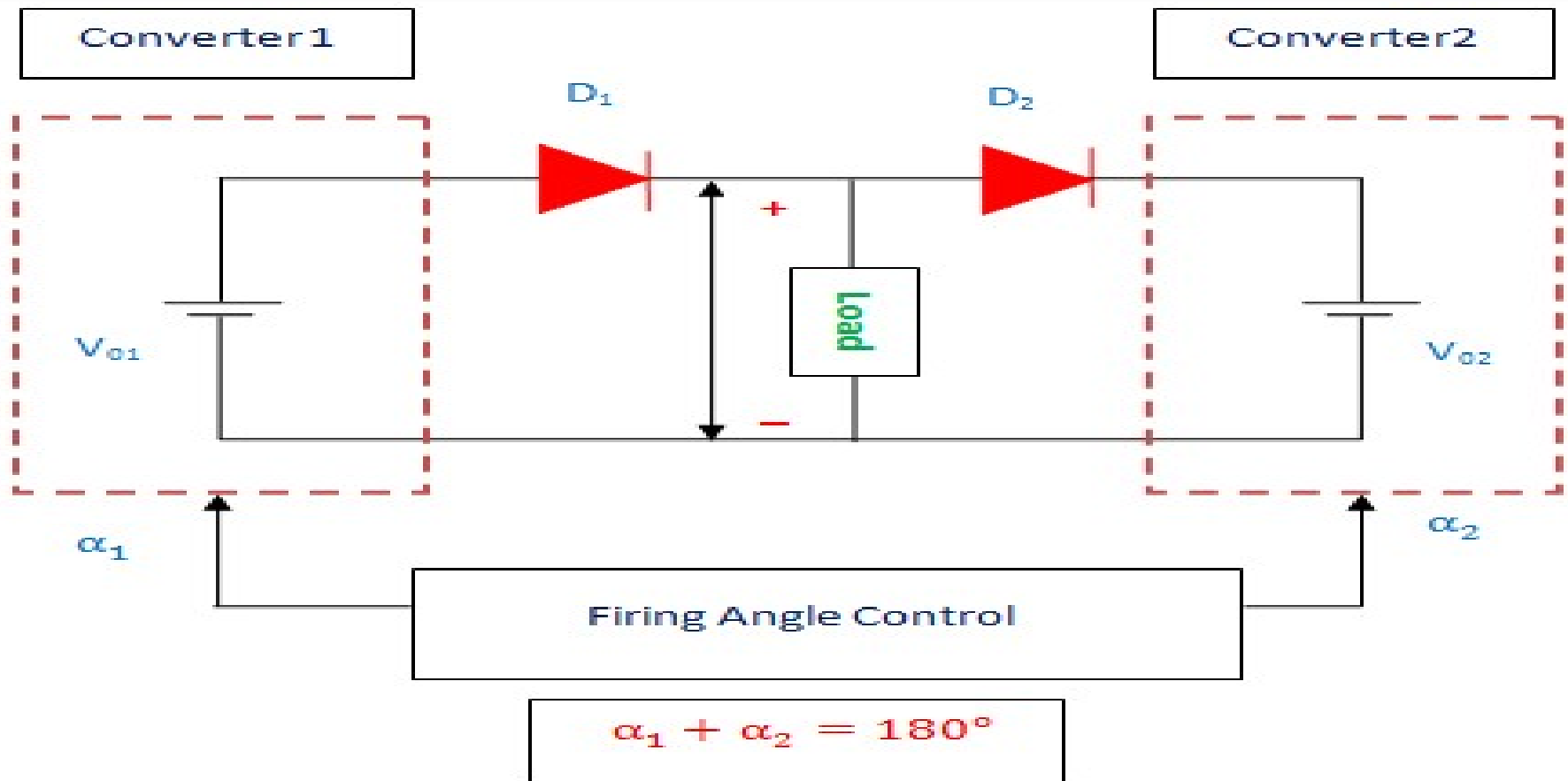
Average output voltage of Single-phase converter = $\dfrac{2V_m \cos \alpha}{\pi}$

Average output voltage of Three-phase converter = $\dfrac{3V_{ml}\cos \alpha}{\pi}$

For converter 1, the average output voltage,

$$V_{01} = V_{max}\cos\alpha_1$$

For converter 2, the average output voltage,

$$V_{02} = V_{max}\cos\alpha_2$$

Output voltage,

$$V_0 = V_{01} = -V_{02}$$
$$V_{max}Cos\alpha_1 = -V_{max}Cos\alpha_2$$
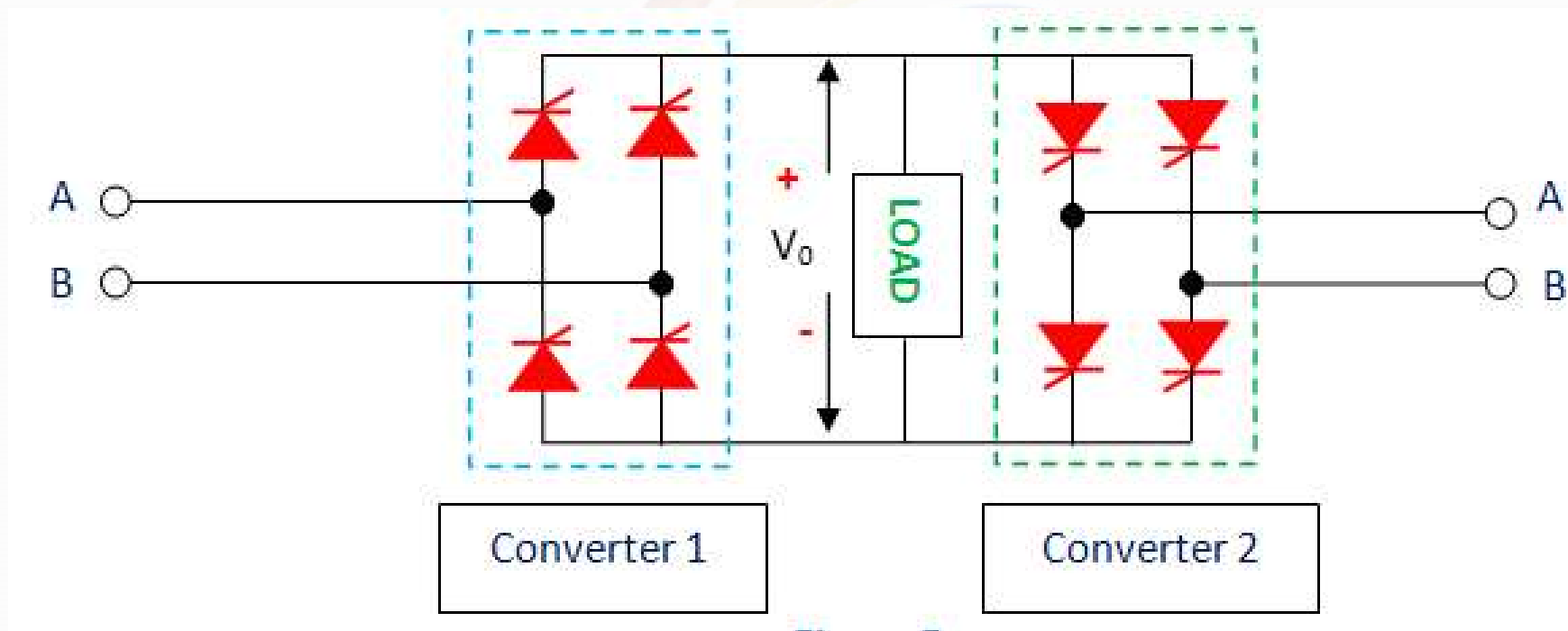$$Cos\alpha_1 = Cos(180^o - \alpha_2) \text{ or } Cos\alpha_2 = Cos(180^o + \alpha_2)$$
$$\alpha_1 + \alpha_2 = 180^o \text{ And } \alpha_1 - \alpha_2 = 180^o$$

The firing angle can never be greater than 180°.

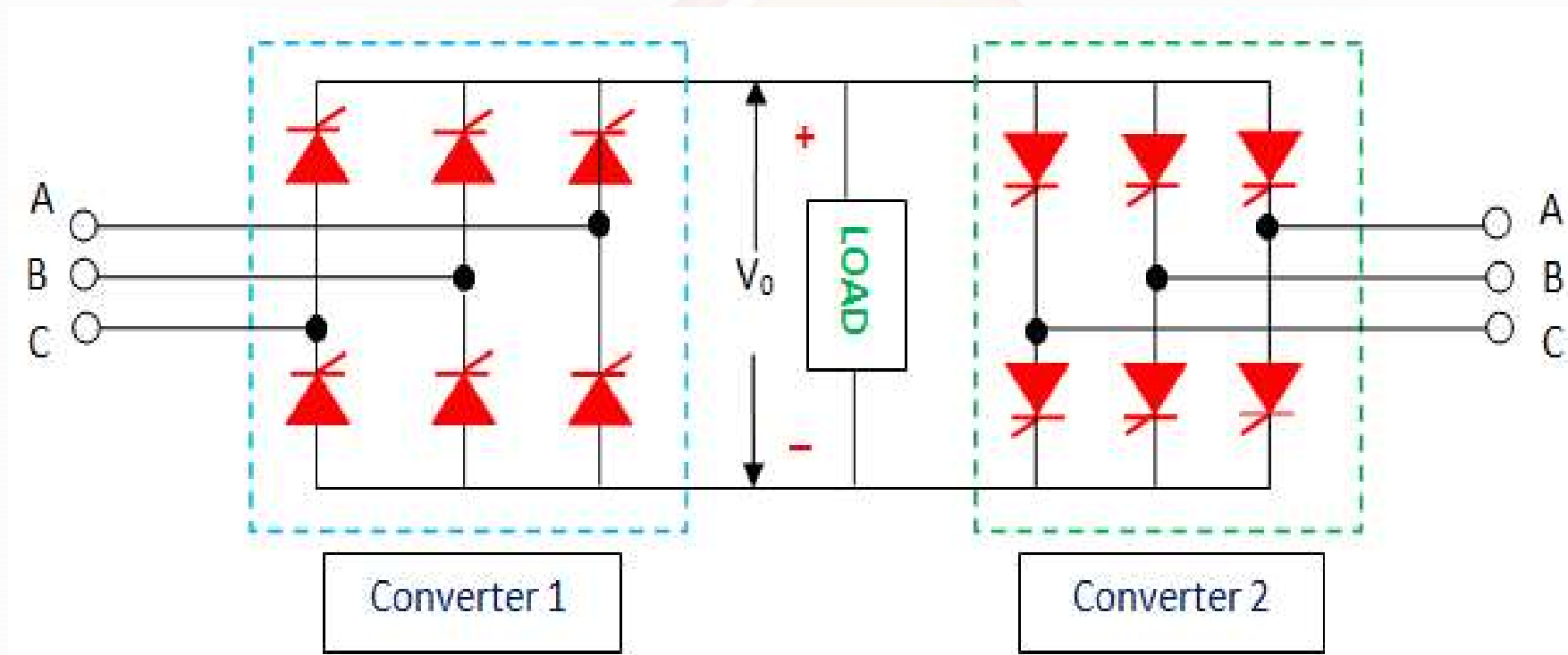$$\alpha_1 + \alpha_2 = 180^o$$

Single phase Dual Converter

Three Phase Dual Converter

Converter 1   Converter 2

Application of Dual Converter

➢ Direction and speed control of DC motors.

➢ Applicable wherever the reversible DC is required.

➢ Industrial variable speed DC drives.

Reference:

All The contents are taken from open Source

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