

### 3.8 Resonant converter

A resonant converter is a type of electric power converter that contains a network of inductors and capacitors called a "resonant tank", tuned to resonate at a specific frequency.

There are multiple types of resonant converter:

Series resonant inverter

Parallel resonant inverter

Class E Resonant Converter

Class E Resonant Rectifier

Zero Voltage Switching Resonant Converter

Zero Current Switching Resonant Converter

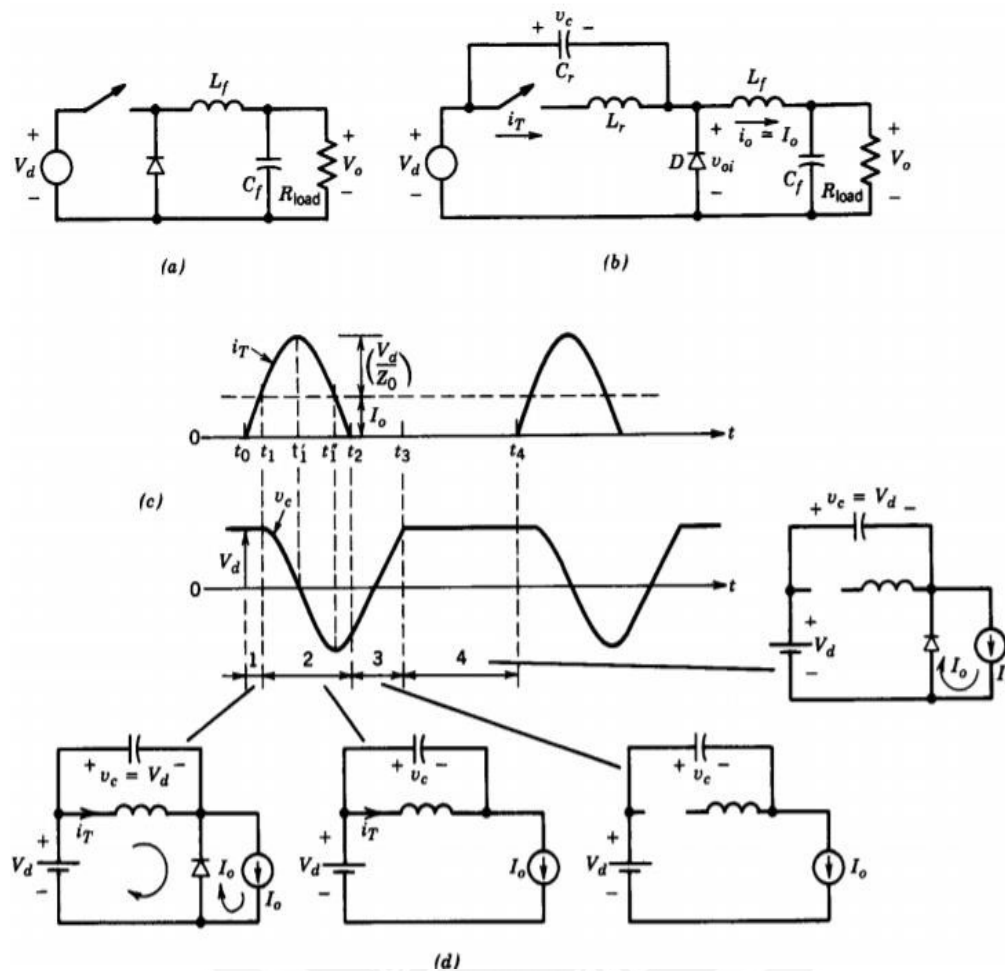
Two Quadrant ZVS Resonant Converter

Resonant dc-link inverter

#### Need for resonant converter

- Hard switching is based on on/off– Switching losses– Electromagnetic Interference (EMI) because of high  $dv/dt$  and  $di/dt$  SMPS size decreases with increasing switching frequency.
- Target is to use as high switching frequency as possible – Switching losses are reduced if voltage and/or current are zero during switching.

## ZCS Resonant-Switch Converter



**Figure 3.8.1 ZCS CONVERTER**

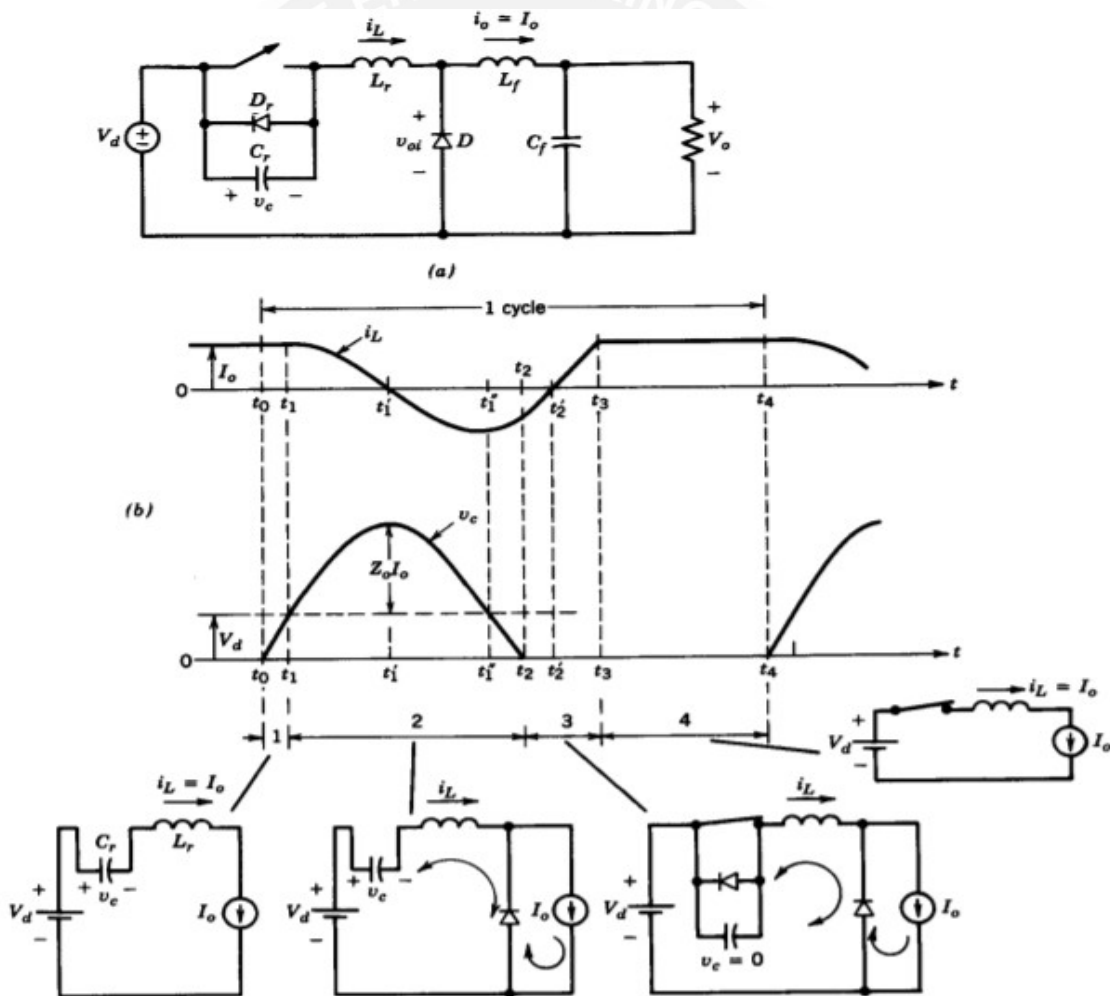
[Source: "Power Electronics" by P.S.Bimbra, Khanna Publishers Page: 294]

### Operation principle

- ✿ Current  $I_o$  goes through the diode
- ✿  $C_r$  is charged to the supply voltage  $V_d$
- ✿ Switch is turned on – Diode  $D$  conducts until at  $t_1$  current is equal to the load current
- ✿  $L_r$   $C_r$  is a resonant circuit discharging  $C_r$

- At  $t_2$  current goes to zero and switch turns off
- Output current  $I_o$  charges  $C_r$  to the supply voltage
- At  $t_3$  diode starts to conduct

### ZVS Resonant-Switch Converter



**Figure 3.8.2 ZCS CONVERTER**

[Source: "Power Electronics" by P.S.Bimbra, Khanna Publishers Page: 295]