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NPTEL ONLINE CERTIFICATION COURSE

# Charging Infrastructure

## Lecture-9

## Single-phase Boost PFC Converter

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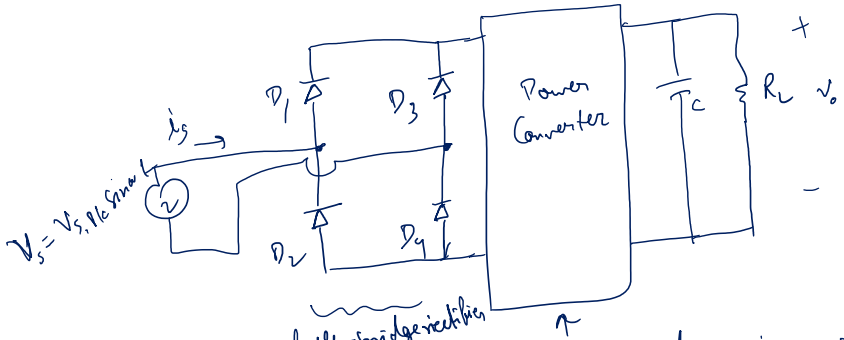
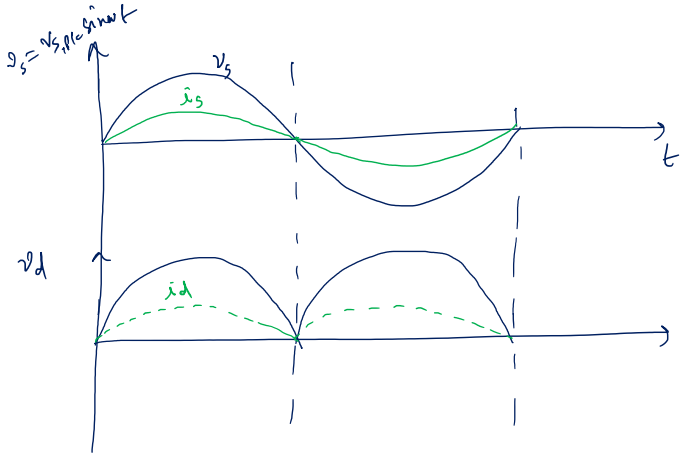
# Recap

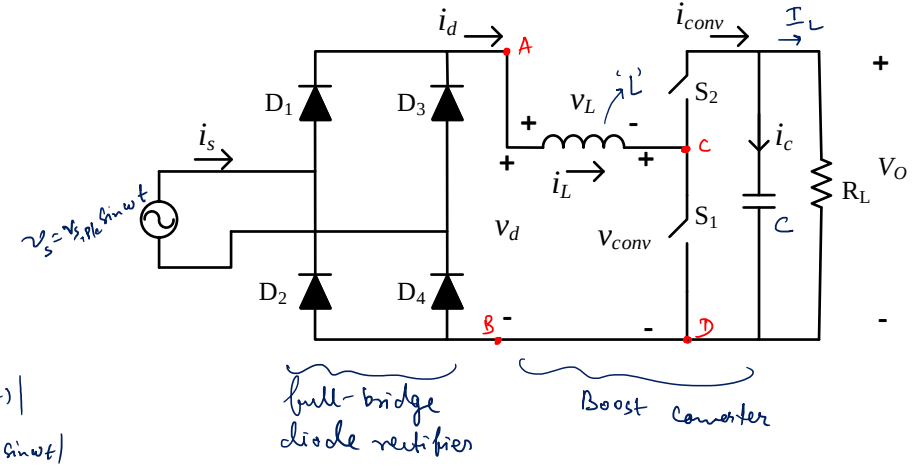



The input impedance is resistive in nature

⇒ Power factor correction (PFC) converter

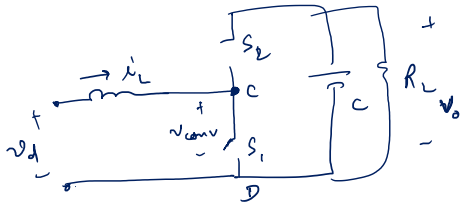
# Boost PFC




$v_d = |v_s(t)|$

$v_d = |v_{s,pk} \sin \omega t|$

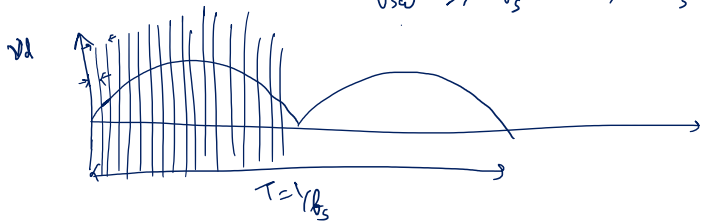


# Boost PFC

Consideration

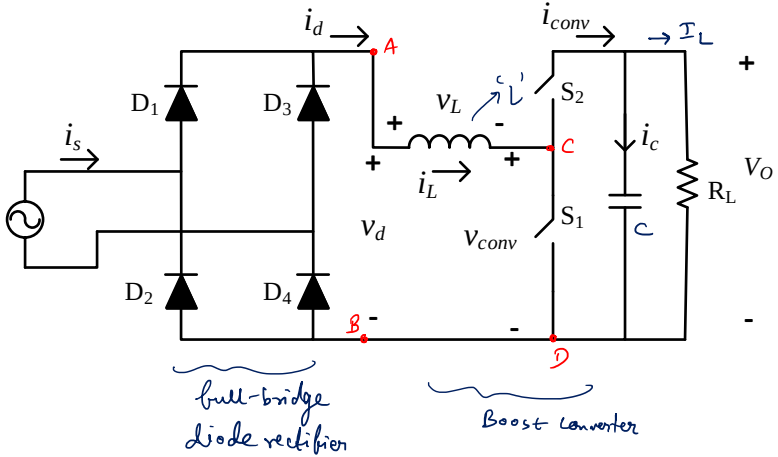
The switching freq. of $S_1, S_2$ switches >> the supply frequency

$f_{sw} >> f_s \Rightarrow T_s << T$



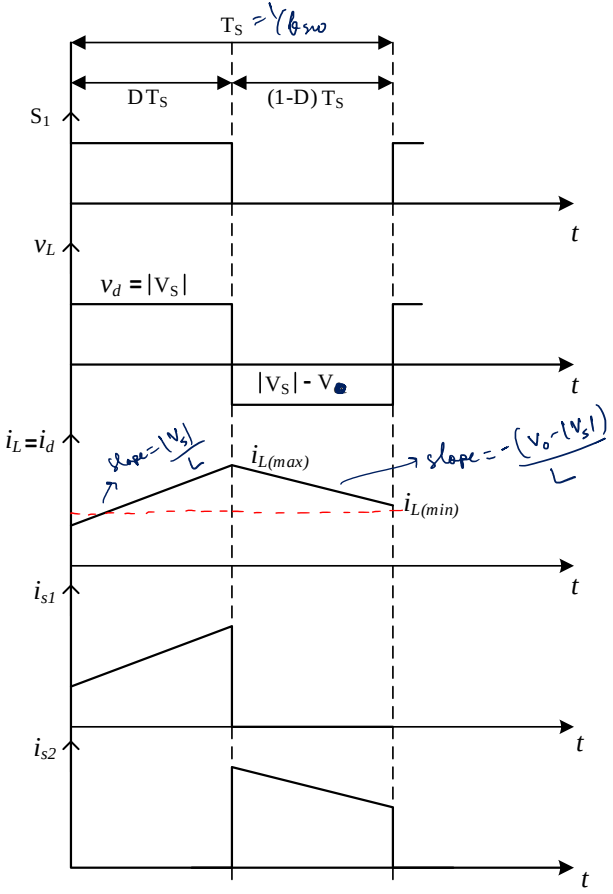

$(T_s = 1/f_{sw})_{v_s = V_{s,pk} \sin \omega t}$

$\Rightarrow$ the $v_d = |v_s(t)|$ is nearly constant during one switching period

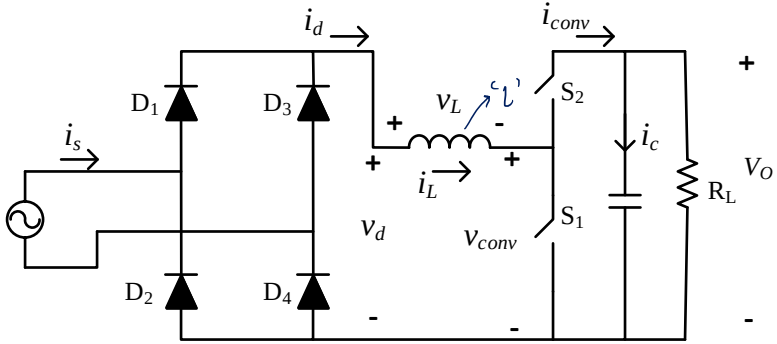



Let us take, 'D' is the duty ratio of switch '$S_1$' at one of the switching period

$|v_s|$ → is the $v_d$ voltage at one of the switching period

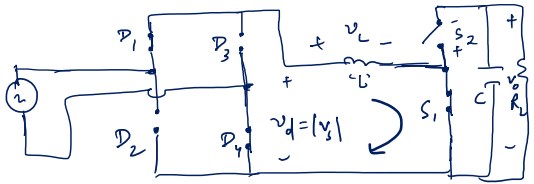



During '$DT_s$' → $S_1$ conducts current in 1 direction, $S_2$ blocks voltage of one polarity → $V_{S_2} = -V_o$

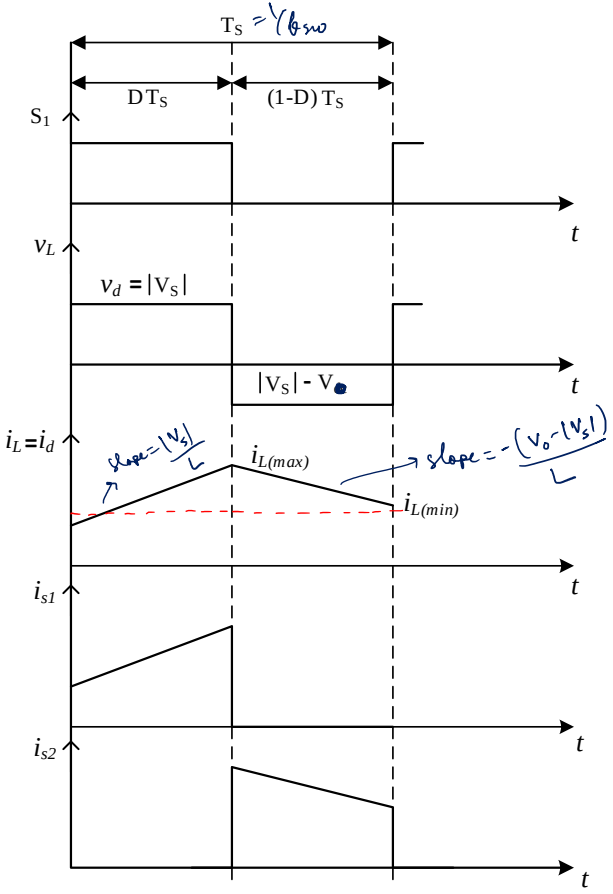



In the half cycle, $D_1$ & $D_4$ are forward biased

During '$DT_s$', $S_1$ is ON → $S_2$ is off → $V_{S_2} = -V_o$

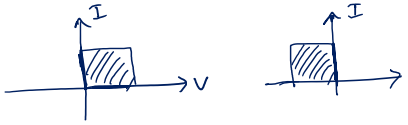



$v_L = L\frac{di}{dt} \Rightarrow \frac{di}{dt} = \frac{|V_s|}{L}$




During '$DT_S$' → $S_1$ conducts current in 1 direction, $S_2$ blocks voltage of one polarity → $v_{S_2} = -v_o$

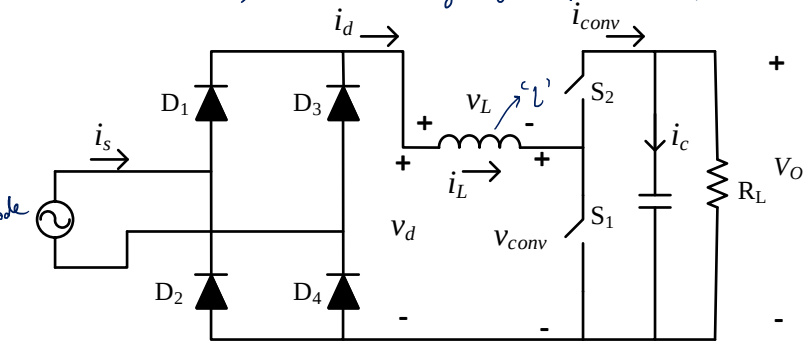
During '$(1-D)T_S$' → $S_2$ conducts current in 1 direction, $S_1$ block voltage of one polarity → $v_{S_1} = v_o$




$S_1$ ↓ MOSFET, IGBT, BJT

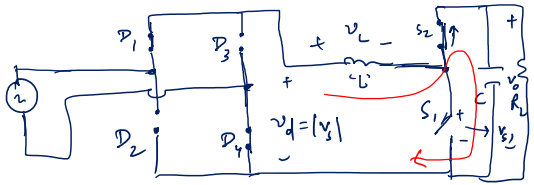



$S_2$ ↓ Diode, body diode of MOSFET,




In the half cycle, $D_1$ & $D_4$ are forward biased

During '$(1-D)T_S$', $S_2$ is ON → $S_1$ is off → $v_{S_1} = v_o$




$v_L = |v_s| - v_o$

$v_o > |v_s| \Rightarrow v_L$ is -ve $\Rightarrow \frac{di}{dt} = \frac{-ve}{\frac{|v_s| - v_o}{L}}$

# Thank You