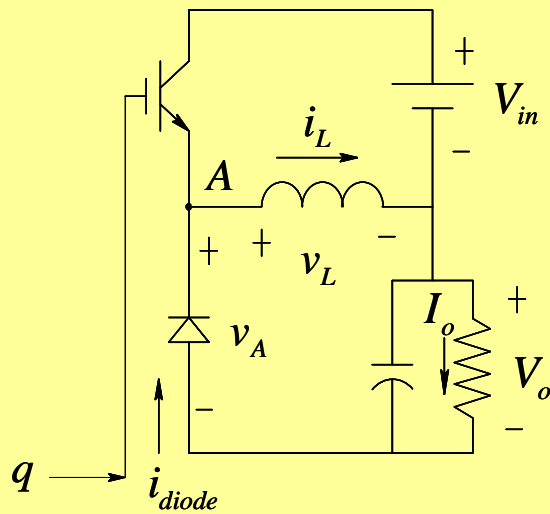


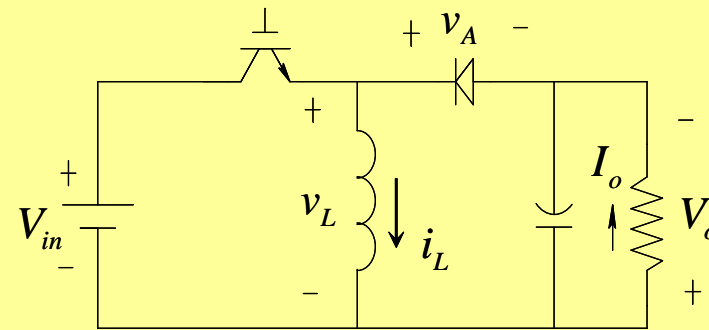
# Buck-Boost (Step-Down/Up DC-DC) Converters

- Applications
- Operation in Steady State

# BUCK-BOOST CONVERTER ANALYSIS IN DC STEADY STATE

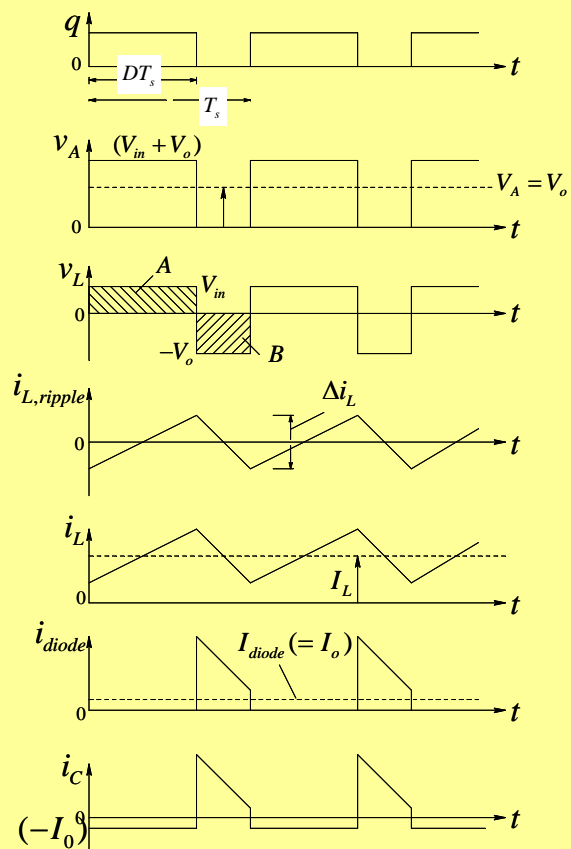


(a)



(b)

# Buck-Boost converter: operation and waveforms



$$\frac{V_o}{V_{in}} = \frac{D}{1-D}$$

$$\Delta i_L = \frac{V_{in}}{L} DT_s = \frac{V_o}{L} (1-D) T_s$$

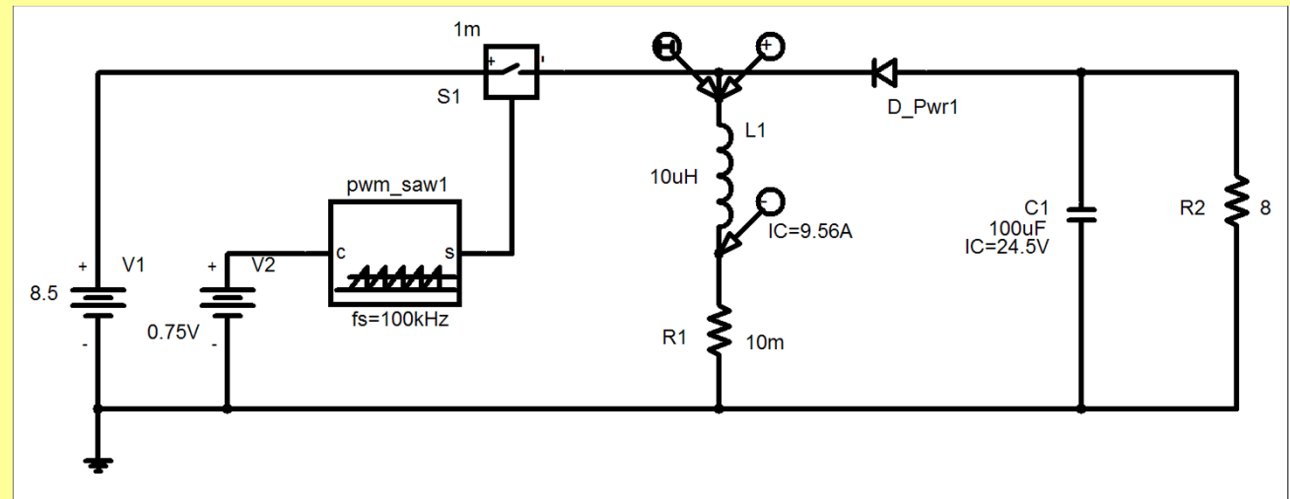
$$I_L = I_{in} + I_o$$

$$V_{in} I_{in} = V_o I_o$$

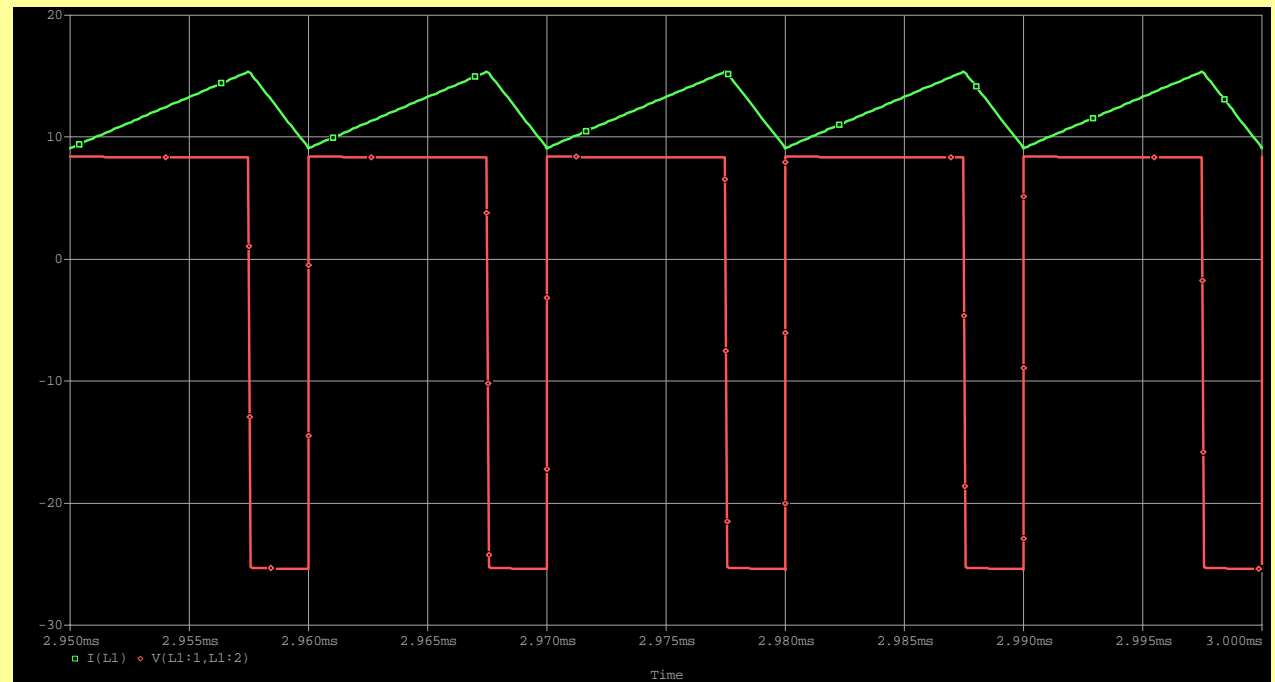
$$I_{in} = \frac{V_o}{V_{in}} I_o = \frac{D}{1-D} I_o$$

$$I_L = I_{in} + I_o = \frac{1}{1-D} I_o = \frac{1}{1-D} \frac{V_o}{R}$$

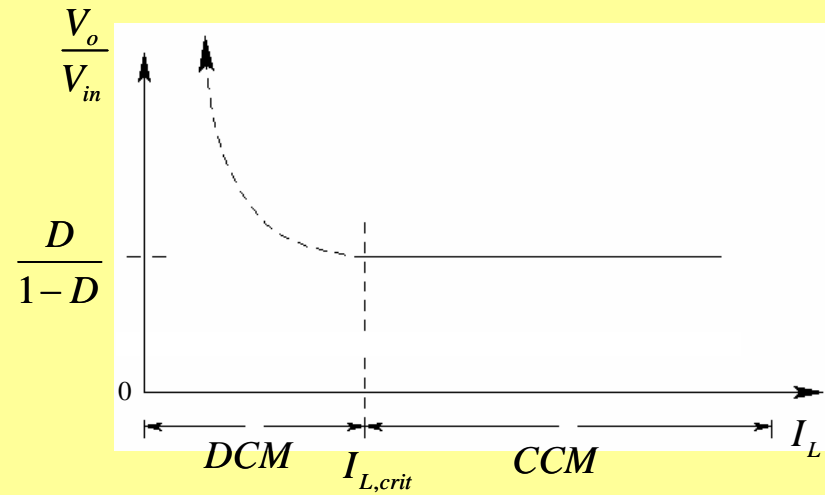
# PSpice Modeling:



# Simulation Results



## Buck-Boost converter: voltage transfer ratio



# Summary

- Buck-Boost (Step-Down/Up DC-DC) Converters
  - Applications
  - Operation in Steady State