



Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous College Affiliated to University of Mumbai)

Applied Science and Humanities Department

Course: ET101 Basic Electrical Engineering Lab

Class: F.Y

Sem.: I

Academic Year: 2021-22

Experiment 9: Switched Mode DC-DC Power Converters (Basic Topologies)

Objectives:

- 1) Review the literature
 - a) To study need of SMPS Vs. linear and their applications
 - b) To study operating principles of Buck, Boost and Buck-Boost PWM DC-DC Converters
 - c) To study design equations for the design of inductor and capacitor in SMPS assuming ideal switches
 - d) To understand effects of energy storing components in SMPS design.
- 2) Solve the design problems for Buck, Boost and Buck-Boost converter by taking help of steady state DC analysis and Continuous conduction mode near ideal switches.
- 3) Verify the solution of design problems with computer simulator
- 4) Create a document highlighting the important learnings from the experiment carried out. Ensure that you produce good quality figures with detail specifications and logical flow in the document.

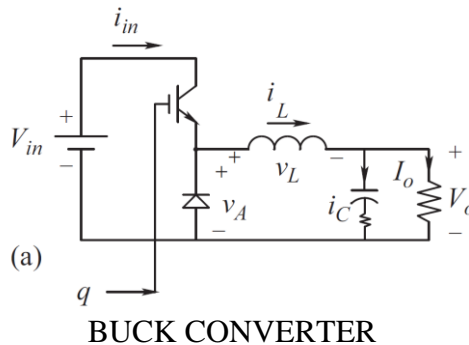
Note: (Courtesy: All the figures mentioned here are directly taken from a book: "Power Electronics: A first Course" by Ned Mohan, John Wiley & Sons, Inc.2012)



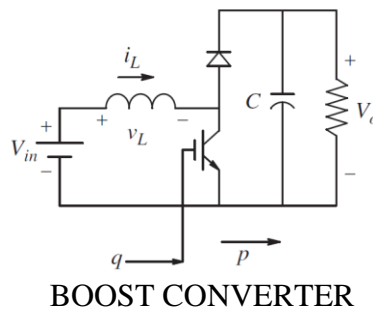
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Design Problems to be solved:

(1) Design a Buck converter for converting a variable input DC in the range 36-72 Volts, to get a regulated output at 12V and 1A maximum. The switching frequency can be set at 50kHz. The maximum peak current ripple can be permissible up-to 10%. The maximum output voltage permissible ripple is 2%. Estimate the value of Inductor and the output filter capacitor. Find out the Duty cycle range for the input variation at 100% load. Verify the results by Computer simulation. Assume ideal switch and continuous conduction mode.



(2) Design a Boost converter for converting a variable input DC in the range 5 Volts, to get a regulated output at 12V at 3A maximum. The switching frequency can be set at 50kHz. The maximum peak current ripple can be permissible up-to 10%. The maximum output voltage permissible ripple is 2%. Estimate the value of Inductor and the output filter capacitor. Find out the Duty cycle range for the load variation from 10% to 100%. Verify the results by Computer simulation. Assume ideal switch and continuous conduction mode.



(3) Design a Buck-Boost converter for converting a variable input DC in the range 36-72 Volts, to get a regulated output at 48V at 2A maximum. The switching frequency can be set at 100kHz. The maximum peak current ripple can be permissible up-to 10%. The maximum output voltage permissible ripple is 2%. Estimate the value of Inductor and the output filter capacitor. Find out the Duty cycle range for the supply voltage variation at 50% load. Verify the results by Computer simulation. Assume ideal switch and continuous conduction mode.

