

Design Assignment: Buck-Boost Converter

Assignment Objective:

Design, simulate, and analyze a Buck-Boost DC-DC Converter using MATLAB-Simulink, followed by presenting your findings in a technical report formatted in accordance with IEEE conference guidelines.

Assignment Details:

1. Design Specifications

Input Voltage Range: $V_{in} = 10V$

Output Voltage: $V_{out} = 15V$

Output Power: $P_{out} = 25W$

Switching Frequency: $f_{switching} = 50kHz$

Ripple Specifications:

Output Voltage Ripple: $\leq 2\%$ of V_{out}

2. Tasks and Deliverables

A. Design and Analysis

Circuit Design: Calculate the values of the inductor, capacitor, and other critical components to meet the design specifications. Use fundamental equations for a buck-boost converter.

Operation Mode: Assume continuous conduction mode (CCM) for the design but comment on conditions that might lead to discontinuous conduction mode (DCM).

B. Simulation (MATLAB-Simulink Only)

Simulation Environment:

- Build the buck-boost converter circuit using MATLAB-Simulink.
- Use standard Simulink blocks such as power electronics switches, inductors, capacitors, and measurement blocks.

Simulation Outputs:

- Steady-State Waveforms: Plot input voltage/current, output voltage/current, inductor current, and switching signals.

C. Technical Report

Abstract: Brief summary of the design goals, methodology, and findings.

Introduction:

- Importance and applications of buck-boost converters.
- Objectives of the assignment.

Design Methodology:

- Calculations for component selection.

- Assumptions and considerations.

Simulation Setup:

- Description of MATLAB-Simulink setup.
- Circuit diagram screenshot from Simulink.

Results:

- Tabulate key results: input/output voltages, current ripple, voltage ripple, etc.
- Include graphs and waveforms from simulations.

Discussion:

- Analyze results against the design specifications.
- Highlight any deviations and suggest improvements.

Conclusion:

- Summarize findings.

References:

- Cite any books, papers, or software tools used.

3. Evaluation Criteria

Design Calculations	25%
MATLAB-Simulink Simulation Accuracy	25%
Analysis and Interpretation	20%
Technical Writing	20%
Formatting and Presentation	10%

4. Submission Guidelines

Submit both the technical report (PDF) and MATLAB-Simulink simulation file (.slx).

Adhere to the IEEE conference paper template available at

<https://www.ieee.org/conferences/publishing/templates.html>.

Ensure all figures and tables are captioned and referenced correctly within the text.

5. Deadline

Assignment due: 31st January 2025

This assignment integrates circuit design, MATLAB-Simulink simulation, and technical communication to provide hands-on learning in power electronics. Good luck!