

EENG 4580/5480: Power Electronics
Project
Due Date: 3rd Dec, 2024

Description:

This project focuses on the design and development of power electronics applications. You will need to apply all the course knowledge to create your group design (simulation). Please select one of the following options and the corresponding specification as your project goal:

Project Options for Undergraduate Students

- Multi-terminal DC-DCs (24Vdc PV input, 24Vdc Bi-directional battery, and 36Vdc output)
- AC-DC LED Driver (120Vdc input, 16 LEDs, 48Vdc output, with dimming)
- PV inverter (0-200Vdc panels, 120Vac output)

Project Options for graduate Students

- AC-DC On-Board Battery Charger (120Vac input, 400Vdc and 48Vdc batteries)
- Uninterruptible Power Supply (120/240V input, 120/240V output)
- 3-phase grid-following inverter (800Vdc input, 480Vac, min. 100kW, PQ control)

Remark: No isolation is required; each group will be given a different power rating.

Step:

Steps are recommended to follow which can minimize your effort.

1) Select a topology that fills for the selected application. **Remark:** Recall your memory from the lecture, what the general system performs, and study the specifications clearly, such as the power, voltage, and current ratings.

2) Derive the general equations for your circuit, such as P_{out} , P_{in} , Duty, i_L , Δi_L , v_c , and Δi_C .

- 3) Select the proper components for your circuit. In your selection, any inductor and capacitor can be assumed as ideal devices.
- 4) Develop a basic closed-loop control for your circuit. The aim of the controller is to ensure stable power conversion under the given specification.
- 5) Design a proper cooling method for circuit semiconductors. **Remark:** Assuming that the maximum device loss is located at the peak point of instantaneous power point on the grid side.
- 6) Build up your simulation and compare the simulation result with the theoretical estimation.

Assessment instruction:

- 1) This project carries 25% of the total marks of this course.
- 2) In this project, you need to submit a **PLECS/ Matlab simulation file**, an **Excel/ Matlab efficiency estimation** file, and an **8-page max. report or a 5 mins video** on or before the due date (3th Dec, 2024).
- 3) For any late submission, a late penalty will be applied. Any one additional day of delay, 10% of the project marks will be deducted.
- 4) Please ensure that you follow all the descriptions above in doing this project.
- 5) Marking criteria:
 - **80%** of the marks are from your technical quality, including but not limited to technical and mathematical accuracy, the correctness of the analysis, and the support of simulation results.
 - **20%** of the mark is from your presentation, such as organization, correct English language, effective illustrations, and tables.
- 6) **NO COPYING IS ALLOWED. If such behavior is found, all the marks in this project will be taken away.**