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**MIDDLE EAST TECHNICAL UNIVERSITY**

**DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING**

**EE 463- Hardware Project – 2023 Fall**

**Simulation Report**

Wind Turbine Battery Charger

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# INTRODUCTION

In this project, we are making a Wind Turine Battery Charger. We will implement a design for the given varying voltage input (15-25 Vll) and output of 10 A current with the 20 percent of ripple. The design specificiations are given in the Github repository of the hardware project.

We investigated the possible topologies that we might implement. We decided based on our calculations and other parameters like feasibility, easy to implement and cost. Throughout this report, we will investigate the toplogy selection in this report and analysis of the simulations. Based on the analysis, we will select our components. We will try to focus on some Bonus Parts as well.

# TOPOLOGY SELECTION

## 3 Phase Thyristor Rectifier

For the 3 Phase Thyristor Rectifier, we researched for this project. The advantages for this topology are;

* High power usage availabilty
* There is no need to have a DC/DC converter, since its output is controllable.

However, for this topology the disadvantages are more dominant;

* It cannot be used with high frequency, which will result in a high volume.
* Its turn-on circuitry is not easy to implement.
* Low switching speed, which will increase losses.

## Centre-Tap Rectifier + Buck Converter

For the 3 Phase Thyristor Rectifier, we researched for this project. The advantages for this topolpgy are;

* Good voltage regulation
* Less ripple
* High efficiency

However, for this topology the disadvantages are more dominant.

* Cost
* Complexity
* High switching losses

## 3 Phase Full Bridge Diode Rectifier + Buck Converter

For this project we decided to choose this topology since it provides a simple solution and cheaper compared to other topologies.

Here are advantages of the selection of this topology;

* Compact Design
* Cost Effectiveness
* Open to more applications
* Reliability

However, we should consider the disadvantages and the major disadvantage we should consider is the efficiency. Buck converter is not efficient due to the components of the circuit. By selection of cicuit components, we will try to be as efficient as possible.

# SIMULATION

# COMPONENT SELECTION

# BONUS PARTS

## PCB BONUS

We will try to build our circuitry on PCB by using a building software. The main idea of the PCB is becoming more compact and neat. While building PCB, we should take consideration of the paths where too much current flows and seperate thoso as much as possible. Also, thermal considerations will be discussed according to our design and heat sink selection.

## COMPACTNESS BONUS

Since we will try to build a PCB, we will try to put our design in a compact and small way. We will try to build our design with a small inductor and capacitor. Our switching frequency becomes important in this manner and we will try to optimize by selecting a high switching frequency to avoid losses. While selecting a high frequency, we should take into consideration of our PCB design such that EMI effects are not afefct too much.

## BMS (Battery Management System)