

**METU EEE**

**STATIC ENERGY CONVERION-I**

**HARDWARE PROJECT REPORT**

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# 1.INTRODUCTION

The demand for the electrical power over the world increased by increasing population. Electrical vehicles, smart houses, wind trubines etc. , which has inevitable to improve by this increasing population, has made a great influence on the power systems and changed the traditional understanding of power system. These developments made the power systems and power electronics area much more important than before. These areas are completes each other. However the project is more about the power electronics area. The power electronics area has a huge scope of electrical engineering.This area contains rectifiers, inverters, DC/DC converters, motor drive circuitries, electrical vehicles, generators, motors etc. These circuitries are commonly used in our daily life and it is developing everyday. In order to understand and contribute the developments at this area, it is essential to have a good understanding of basic topologies of this area. So this project is all about having an understanding of one of the very basic applications of the power electronics area.

This project is a work of full understanding of DC motor drive. The main idea is to drive the DC motor that is applicable at laboratory, by using a variac, the device for arranging the voltage level that is taken from the grid and control the DC motor’s speed. The drive circuitry is a combination of some of the topologies that this discipline covers such as rectifier circuitry and DC/DC converter etc.

# 2.The Description and The Aim of The Project

The project is to design a DC motor drive that is applicable at laboratory and can be seen at Figure 1.

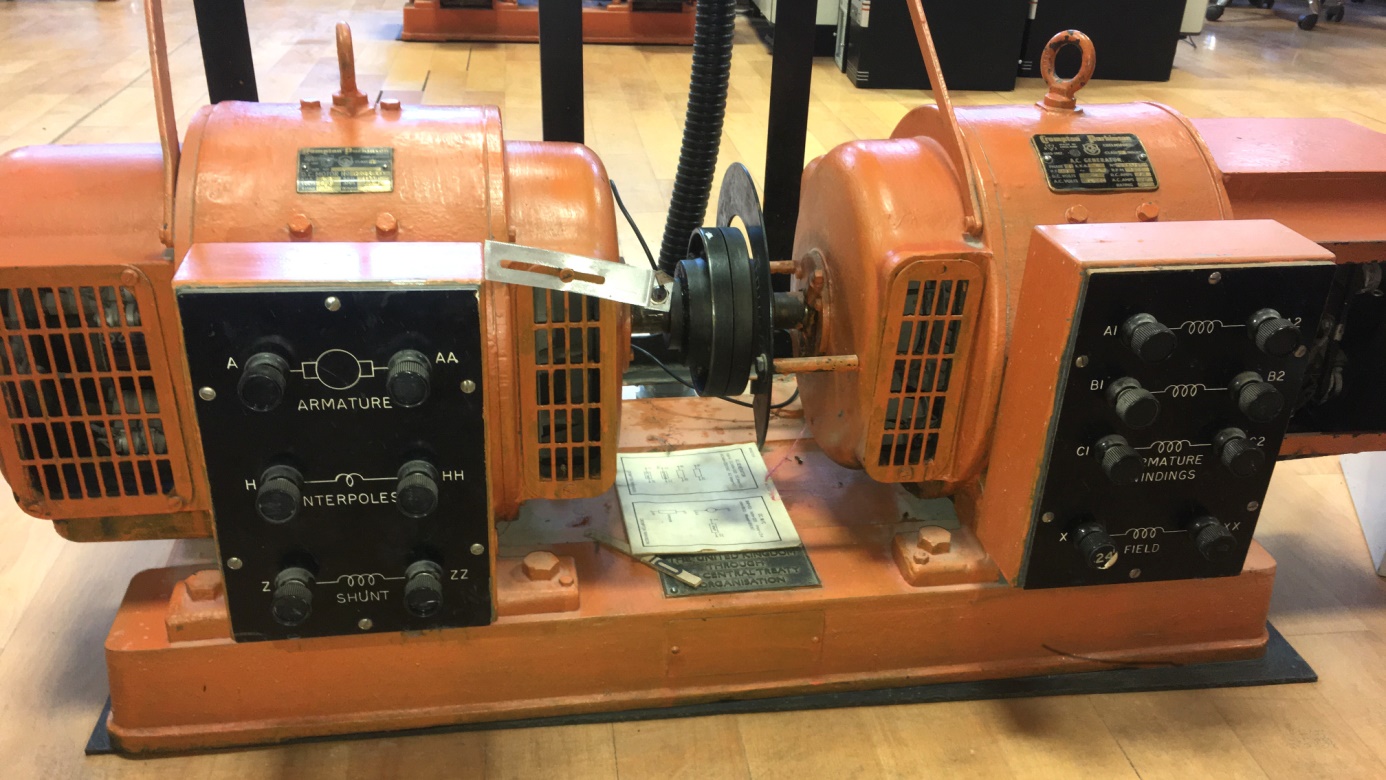


Figure 1:The DC Motor(Crompton Parkinson brand)

This motor is an experimental type motor and it’s rating values can be seen from the below figure.



Figure 2:The Ratings of DC Motor

The motor has;

**-Armature Winding**: 0.8

**-Shunt Winding**: 210 Ω, 23 H

**-Interpoles Winding**: 0.27 Ω, 12 mH

**-Inertia**: TBA

In order to drive this DC motor many circuit topology can be used. However due to simplicity and applicability of the diode rectifier and a buck converter connected topology is choosen which can be seen at Figure 3.

# 3.Design of the Project

The main topology of the design is a three phase diode rectifier and a buck converter. The main working principle of the drive can be examined one by one. Firstly three pahse diode rectifier converts the AC voltage that is supplied by variac and converts it to DC voltage. Changing the variac voltage in order to control the speed of the motor is restricted. So it is impossible to control the DC voltage applied to motor by just using three phase diode rectifier. So the buck converter is used in order to control the DC voltage level that is applied to DC motor. According to the duty cycle applied to the switch (MOSFET) of the buck converter topology, can be seen at Figure 3, the voltage level that is applied to DC motor can be controlled. So that means another circuitry is necessary to drive the MOSFET also. So 555 timer is used in order to drive the mosfet of the buck converter. However that was not enough either. 555 Timer circuitry can not drive the mosfet circuitry alone, so octocoupler circuitry is necessary.

## 3.1.The Main Topology

## 3.2.Thermal Design

## 3.3.The Implementations for Bonuses

After completing the main circuitry, the bonus applications were designed. These are H-Bridge circuitry, PCB design, industrial box implementation, Closed-loop Voltage/Current Control by Arduino. At this section of the report, the details of these will be introduced.

### 3.3.1. H-Bridge

### 3.3.2.PCB Implementation

### 3.3.3.Industrial Box

### 3.3.4. Closed-loop Voltage/Current Control by Arduino

# 4. Test Resuls

# 5. Conclusion

# 6. Appendix

# 7. Referances