# Chapter one

# Introduction

## 1.1 Overview

Development of high performance motor drives are very essential for industrial applications. A high performance motor drive system must have good dynamic, speed command tracking, and load regulating response.DC drives, characterize by their simplicity, ease of application, reliability and favourable cost have long been a backbone of industrial applications as compared to AC drives. DC motors provide excellent control of speed for acceleration and deceleration[1].

DC motors have a long tradition of being used as adjustable speed machines and a wide range of options have evolved for this purpose. They are capable of providing starting and accelerating torques in excess of 400% of rated. And have long been the primary means of electric traction, conveniently portable and well fit to special applications, like industrial equipment's and machineries that are not easily run from remote power sources. DC motor is considered a SISO (Single Input and Single Output) system having torque/speed characteristics compatible with most mechanical loads. This makes a DC motor controllable over a wide range of speeds by proper adjustment of the terminal voltage.Dc motors are always a good option for advanced control algorithm because the theory of dc motor speed control is extendable to other types of motors as well. The power supply of a DC motor connects

directly to the field of the motor, which allows for precise voltage control, and is necessary for speed and torque control applications[1].

## 1.2 Problem Statement

The main problem is to control the speed of dc motor by PI controller and tuning the parameters by self-tuning fuzzy logic.

## 1.3 Proposed Solutions

The speed of separately excited DC motor can be controlled from below and up to rated speed using chopper .There are two control loops, one for controlling current and another for speed. The controller used is Proportional-Integral typewhich remove the delay and provides fast control.

## 1.4 Objective

The objective is to control the dc motor to give a variable speed, which has high performance, reliability and adaptability for different dc motor ratings with good speed response, and develop a system with constant speed at any load condition automatically.

## 1.5 Methodology

### 1.5.1Circuit of dc motor with pi controller

The control circuitconsists of a speed control loop and a current control loop. A proportional-integral (PI) controlled speedcontrol loop senses the actual speed of the motor andcompares it with the reference speed to determine thereference armature current required by the motor.The current control loop consists of a hysteresis current controller (HCC).HCC is used togenerate switching patterns required

for the choppercircuit by comparing the actual current being drawn bythe motor with the reference current. the difference between the desired current, and the current being injected is used to control the switching of the chopper circuit. When the error reaches an upper limit namelyupper hysteresis limit, GTO ison, otherwise GTO is off. And that is called the automatic control theory.

### 1.5.2 Circuit of dc motor with fuzzy logic controller

The triangular membership functions for input variable speed error (E), change in speed error (CE) and control output (Du) i.e. change in firing angle are shown in normalized units. The general considerations in the design of the controller are:

- If both E and CE are zero, then maintain the present control settings i.e. Du=0.
- If E is not zero but it is approaching to this value at a satisfactory rate, then maintain the present control Settings.
- If E is increasing then change the control signal du depending on the magnitude and sign of E and CE to force E towards zero.
- CE and E are change in speed error and speed error respectively (normalized).
- Du is change in firing angle (normalized).

## 1.6 Research Outlines

The main core of our project is to simulate a complete automatic speed control system for a DC motor. By using dc chopper.

This system will be able to control the DC motor speed at desired speed regardless the changes of load.

## 1.7 Thesis layout

Chapter one consists of introduction about the project that mentions problems statement, proposed solutions and methodology.Chapter two represents theory and literature review that consist of the types of dc motor and dc chopper.Chapter three represents the system design (PI and fuzzy self-tuning).Chapter four represents the simulations and analyzedresults.Chapter five represents the conclusion and recommendation.