CHAPTER 1

INTRODUCTION

1.1 Introduction

Electricity is used in day-to-day life for domestic and industrial applications, such as lighting in homes, drives in industry and power supply for communication systems. To meet the demands of these varied consumption categories satisfactorily, the electrical power supply system should fulfil certain important requirement.

- the continuity of power supply
- the availability of power supply on demand
- the economical availability of power
- keeping the supply voltage within permissible limits
- keeping the supply frequency within permissible limits

As mentioned above, keeping the supply voltage within permissible limits is one important requirement for a power system. Fluctuations in the supply voltage at consumer premises are undesirable. For example, voltage below nominal value reduces the light output of the lamps and if above it will shorten their life time. Motors operated below nominal voltage draw abnormally high currents and may overheat even when carrying the rated load. It is for reasons like these that voltage is required to be maintained within ±5% of the nominal voltage.

Provincial Electricity Authority (PEA) is responsible for providing customers electricity within Thailand, outside Bangkok, Nonthaburi, and Samuthaprakarn provinces.

At present the demand for electricity is increasing very fast, especially industrial loads, mostly motor loads, and all these loads often far from PEA's substations. The presence of these loads cause voltage stability problems in the system and may sometimes lead to voltage instability.

Voltage instability in power system has recently gained an increasing attention. This phenomenon is characterized by a progressive fall in voltage magnitude at a particular location and may finally spread out in the network causing a complete system voltage collapse. The phenomenon has been attributed to the incapability of power systems to meet a certain load demand of reactive power.

The process of voltage instability may take several forms depending primarily on the nature and characteristics of the major loads and the dynamics of system voltage control devices. The presence of certain load types can, under some system transmission/generation conditions, lead to voltage instability in the form of uncontrolled voltage oscillations. Large induction motors are one of such load types as they show a rapaid increase in reactive power demand following voltage falls during starting up.

In this thesis, the various ways of achiving voltage control to prevent voltage drop due to the starting of induction motors that may lead to voltage instability will be discussed. In addition to this

a computer simulation study will be performed in order to illustrate some of the discussed voltage stabilizing methods.

The computer simulation study is divided up into two parts:

- first part is a base case study on part of PEA's present network
- second part is about voltage level improvement

The simulation part of this thesis is made by use of SIMPOW software package, executed on a VAX-2000 work station.

The SIMPOW software package is developed and marketed by ABB Power System AB. It offers tools for calculation of load flow distribution, transient stability condition, eigenvalues and short circuit analysis.