CHAPTER 2

SCOPE OF THE THESIS

In this chapter, different types of loads studied in this work are described. The loads may be static loads, induction motors, or composite loads.

Disturbances used in the simulations are also presented. They are both voltage and frequency variations which may occur in power system.

2.1 Studied load types

In this thesis, both static and induction motor loads are considered. Models are developed for the following load components :

Static loads

- fluorescent lamps
- incandescent lamps
- heaters
- televisions
- etc.

Induction motor loads

Induction machines with different load torque characteristics are considered. Other loads consisting of induction motors, such as air conditioner are included in induction motor loads.

Composite loads

In fact, power system loads are not just one type but consist of various load components. Method for building composite load models are developed.

2.2 Disturbances

The disturbances considered in this thesis are both voltage and frequency variations.

Several types of voltage variations are used in this study to simulate load characteristics, such as sudden voltage changes, gradual voltage changes, etc. The purpose is to represent voltage variations of any type that are encountered in stability studies (i.e. during short circuit conditions, when loads are connected or disconnected.)

Some examples of voltage disturbances are shown in fig. 2.1-2.5.

Similar to voltage variations, several types of frequency variations are considered such as dip types, oscillating types. The dip types can occur when large generators are disconnected. The oscillating types may occur before the power system has been stabilized.

Some frequency variations are obtained from ref. [20], which frequency dips are modelled by the following functions :

$$f(t) = f_o \qquad \text{for } t <= 0$$
$$f(t) = f_o - a*(1-e^{-t/T1}) + b*(1-e^{-t/T2}) \qquad \text{for } t > 0$$

The constants, a,b,T1,T2 can be varied. For example, in fig. 2.6 the constants are a = 2.21 b = 2.625 T1 = 3.069 T2 = 9.195

The oscillating frequency can be modelled by the folllowing equation :

$$f(t) = f_0 + k*\sin(wt)$$

Where k,w are constants that can be varied. Fig. 2.7 shows the oscillating type of frequency where k = 0.2 w = 0.5*π

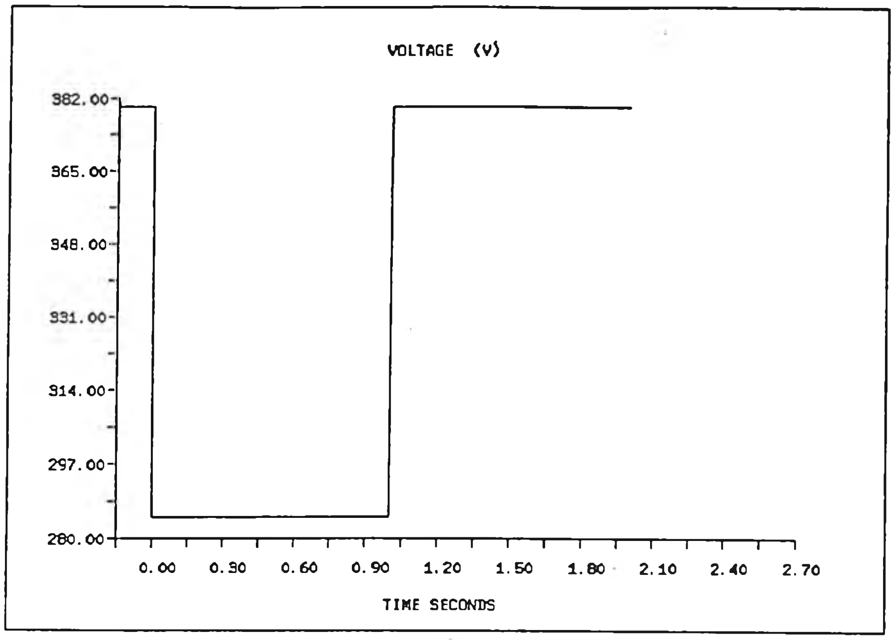

Figure 2.1 Voltage sudden change

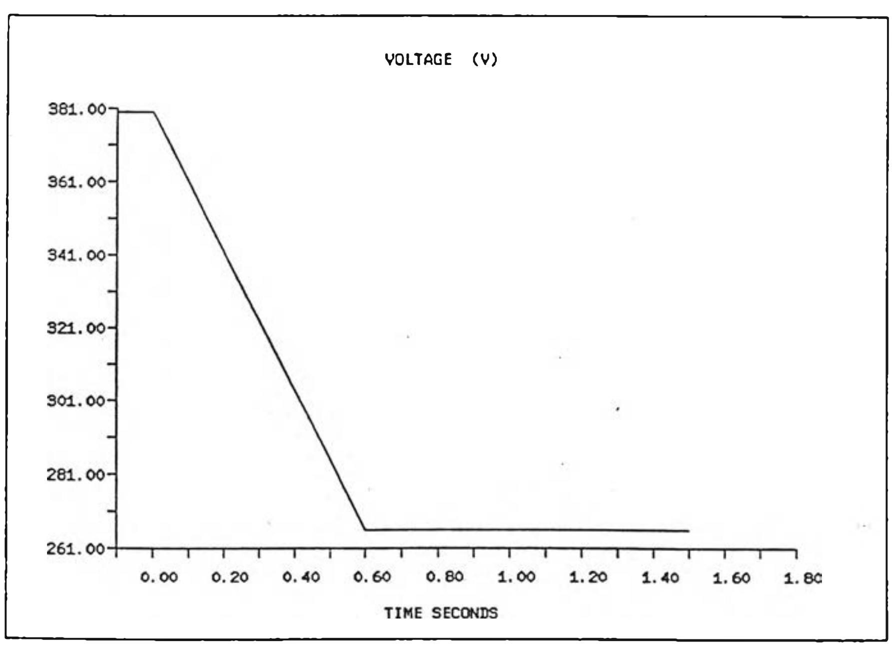

Figure 2.2 Voltage gradual change

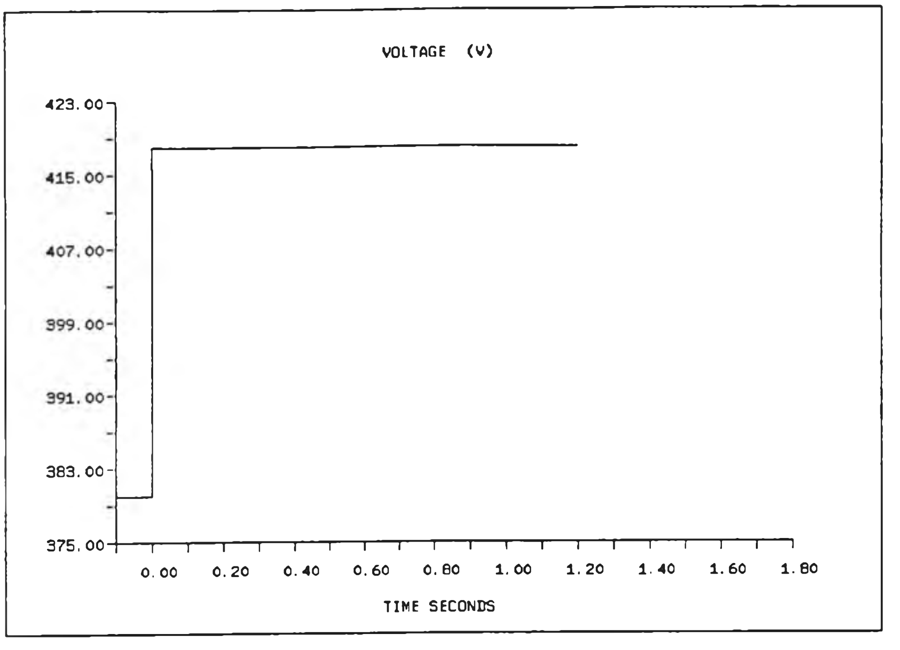

Figure 2.3 Voltage sudden rise

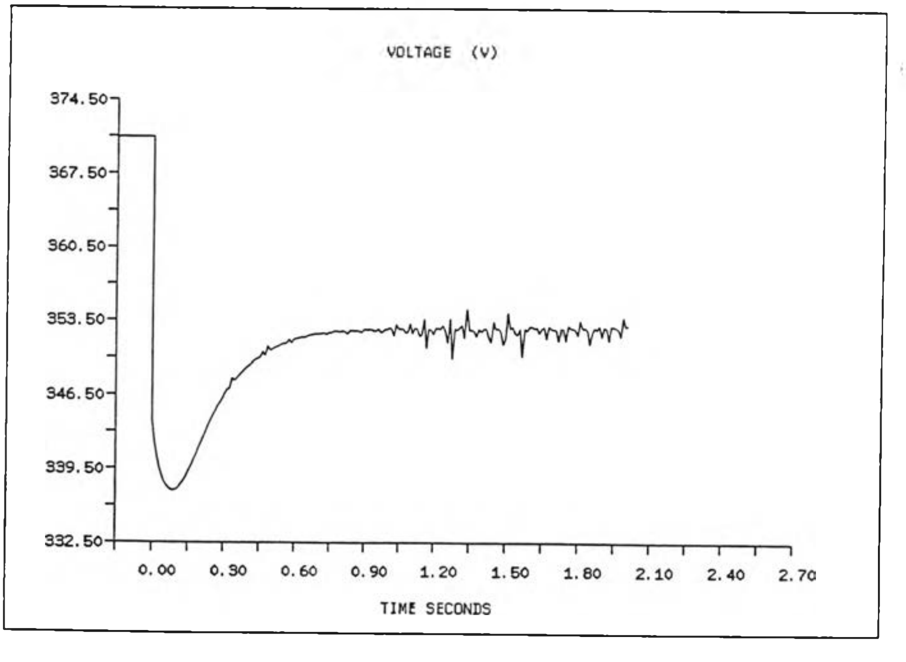

Figure 2.4 Voltage variation simulated by SIMPOW

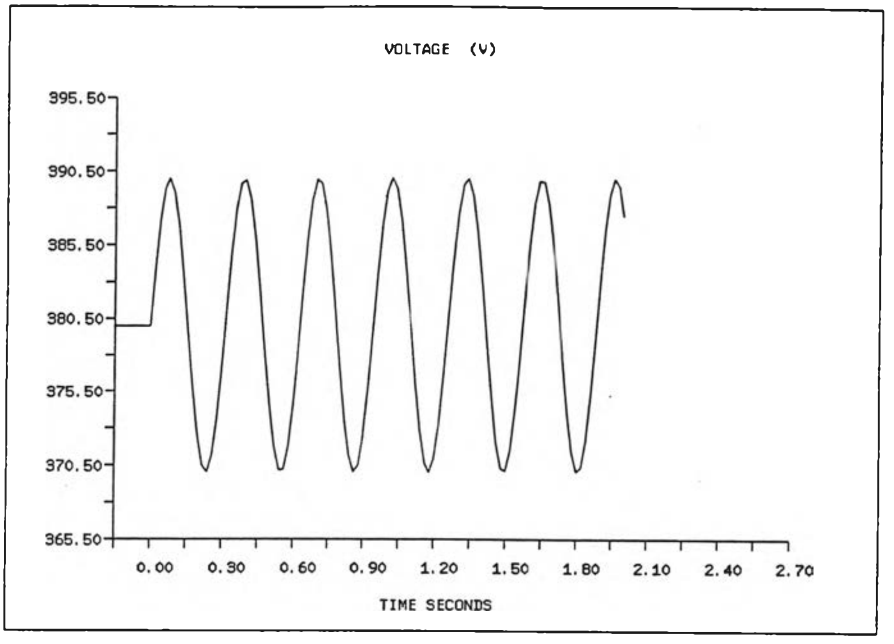

Figure 2.5 Voltage oscillation

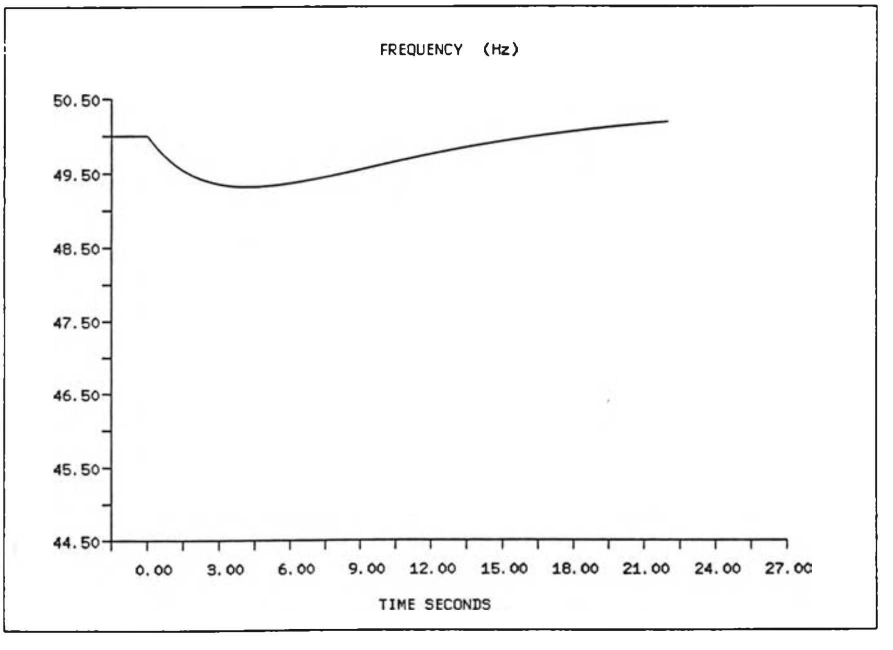

Figure 2.6 Frequency dip

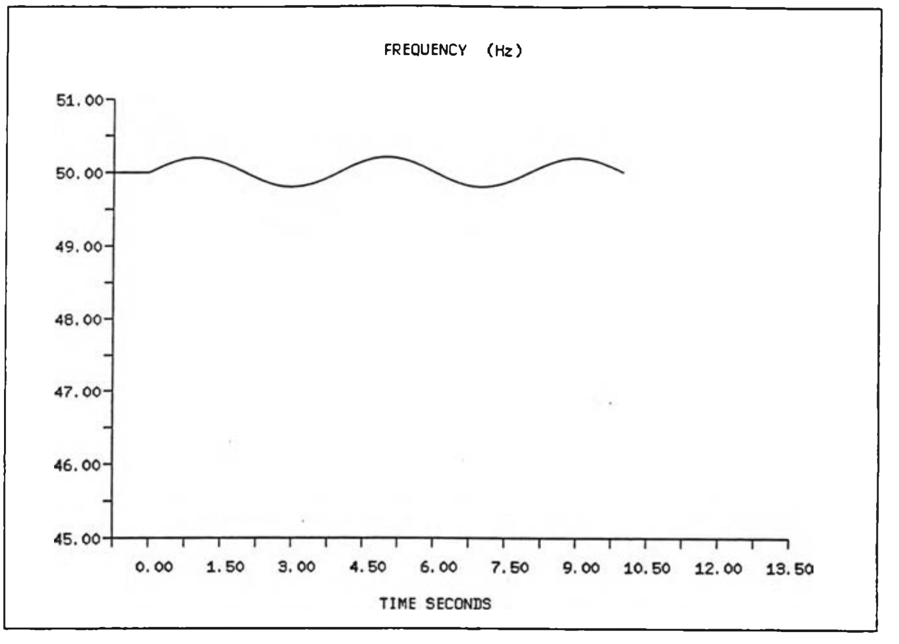

Figure 2.7 Oscillating type of frequency

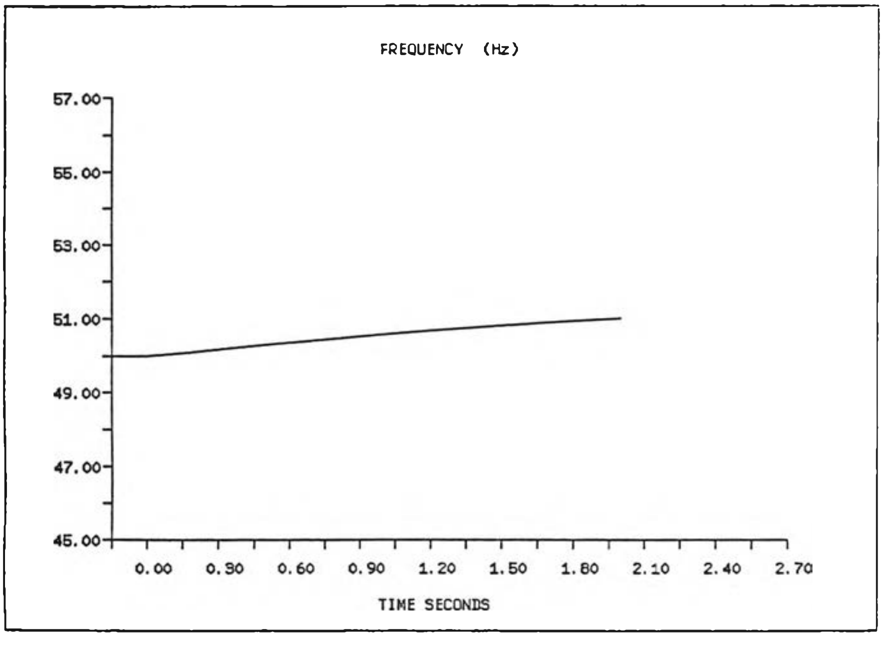

Figure 2.8 Frequency variation simulated by SIMPOW