CHAPTER I

INTRODUCTION

In planning the operation, improvement, and expansion of a power system, many engineering problems must be analysed and studied in advance so that the system will work effectively, economically and safely. The effects of short circuits on the system is one of such problems.

When there is a short circuit on any part of a system, the currents flowing in various parts of the system are considerably higher than usual and the voltage at busbars become lower. To restore the system to its normal condition circuit breakers which are near to the location of the short circuit will be tripped to isolate the fault part from the rest of the system, and then will make to reconnect it when the cause of short circuit disappers. To work properly, the circuit breakers must be able to withstand the current or the power that flow immediately after a short circuit. The aim of a short circuit study is, therefore, to determine the momentary and interrupted currents and the corresponding MVA's for various types of short circuit at various locations in a system. The data obtained from the study serve to determine the ratings of circuit breakers and the settings of relays which control the circuit breakers.

With the greatly increasing rate of power consumption, the power systems in Thailand, especially the Yanhee Electricity Authority (Y.E.A.) system, are rapidly expanding. In order to plan ahead, methods for analysing the Y.E.A. power system are being developed. In this country, the available tools for such analysis are some d.c. network analysers and electronic digital computers. On the grounds of economics, efficiency, and accuracy, the latter are more favourable.

In this investigation, FORTRAN programs for an I.B.M. 1620 electronic digital computer are developed to analyse the fault current distribution as well as fault level in a power system under a three-phase short circuit condition, the most severe condition, usually; under a one-phase short circuit condition , the condition most frequently occurs. The solutions may be used in determining the adequate MVA ratings of circuit breakers and in determining the proper settings of relays. The technique used is the matrix method which is suggested by Brameller and Deanmead in the published paper (1). In this method, the system nodal admittance matrix is formed and inverted to a nodal impedance matrix. The latter matrix and the prefault voltage distribution are used to determine the fault currents and the fault voltage distribution. The fault current distribution in a system element is calculated from the characteristic of the element and the fault voltages at the busbars to which it is connected. In order to obtain accurate results, line resistances and line shunt susceptances as well as line reactances are used to represent transmission lines handled in this method. Loads and transformer tap settings are also taken into consideration. If a load flow study on the system at a certain condition is done prior to the short circuit study at the system condition, informations from the load flow can be used as data for the short circuit programs to obtain exact solutions. If there is no such information the approximate solutions may be obtained from the estimate terminal voltages and outputs of generators in the system.

As examples, the developed programs are used to analyse the effects of three-phase and one-phase short circuits on the Y.E.A. 230 KV and 69 KV systems at the present condition and the condition in 1970.