OPTIMAL MINIMAL SOLUTION FOR TOTAL LOSSES USING EVOLUTIONARY PROGRAMMING BASED ON REACTIVE POWER LOAD VARIATION BY CONSIDERING VOLTAGE STABILITY INDEX

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ABSTRACT

The stability of an electrical system is a very important matter in order to prevent electrical failure and electricity blackout. With the development of country and increasing number of population, there is an increase in the electricity demand. So, there will be a lot of continuous change in the line interconnection, supplier and electricity demand which makes the system more complicated. As a result, the system will be working under stress condition and its operating point will be close to its voltage stability limit. The common consequence from this problem would be a voltage collapse which will increase the total losses in the system. Hence, a reactive power management must be applied to mitigate this problem. Besides, it is also important to determine the voltage limit of the system before it becomes unstable so that the appropriate actions can be taken earlier. This paper presented Evolutionary Programming based optimization technique to find optimal minimal solution for total losses considering reactive power load variation. The research and investigation was carried out on IEEE 30-buses system and the result obtained was analyzed. In order to determine the stability strength of the system after optimization, a voltage stability index is used. The system is considered unstable if the value obtained is equal or larger than 1. If this happens, the system will began to collapse by causing a voltage drop in the corresponding bus. Two types of voltage stability index which is Line Stability Index and Line Stability factor were used in order to compare their reliability in determining the stability of the system.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Recently, the fast developed cities, increasing number of population and deregulation of electrical sector has resulted in high power demand to the load. This has put the electrical system under stress due to limited power which then will lead to system instability [1]. The distribution systemis meant to distribute the electricity to the load or customer according to their load demand. In order to deliver power to the load properly, a stable power system is required to ensure that the power delivered to the load is secured and have no disturbances. Power system stability is a very important factor in an electrical system which is always related to the voltage stability. Voltage stability can be defined as the ability of an electrical system to maintain a constant permissible voltage at all buses whether in a normal condition or under disturbance circumstances [2]. The disturbance in this case is a sudden change that occurs in the system which can disturb the performance of the system such as voltage drop, interruption in power supply and power losses [3]. A large disturbance can even threaten the voltage stability of the system [4]. The system is considered stable if the voltage is within the limit of 0.9 to 1.1 per unit. The system instability usually occurs when there is insufficient reactive power transferred to the load during the critical load condition or the network transfer capability of the system is reduced because of the disturbances in the system[2]. The system instability will lead to the voltage collapse which then will increase the total losses in the system. Therefore, to ensure that the power system is operated optimally and fulfilled its basic requirements,