DETERMINATION OF FAST VOLTAGE STABILITY INDEX (FVSI) USING EVOLUTIONARY PROGRAMMING (EP) TECHNIQUE TO MAINTAIN SYSTEM STABILITY

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ABSTRACT

Nowadays, electrical energy used is increasing from day onwards, so in order to meet the demand, power systems are operating closer to their maximum capacity which will cause higher risk to the power system instability. It also will cause the shutdown of entire power system. Thus, this paper proposes an application of Fast Voltage Stability Index (FVSI) to power system stability using Evolutionary Programming (EP) technique. FVSI is used to verify the stability of the systems based on the variation of reactive power load. The value of FVSI close to unity shows that the line has reached its instability limit. This could cause sudden voltage drop to the corresponding bus. EP technique involves mutation process which is used to generate offspring from parents. The biggest advantage of EP is it allows development of complex applications which in turn the solution will fit the needs of the users. The standard IEEE 30-bus test system has been used as a case study in this research. This paper shows the relationship between the numbers of reactive power load bus, search step size and number of population with total losses and value of FVSI. From the simulation results, it indicates that the proposed technique has been able to reduce the system losses and able to verified the voltage stability system with the application of FVSI.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Voltage instability is one of the causes to power system stability problems. Voltage stability is the capability of a power system to sustain acceptable voltages at all nodes in the system under normal and contingency condition. In recent years, voltage instability has been known as a serious problem due to several incidents of voltage collapse in France, Japan and Florida. Because of rising in load demand and line outage, power systems operate closer to their maximum capacity limit. This could cause sudden voltage drop to the corresponding bus which leads to total blackout to the whole systems. Thus, some actions have to be taken before becoming worst. Power system stability can be improved by reallocating reactive power in the system such as by varying the reactive power load [1].

In recent years, Artificial Intelligence (AI) technique such as Genetic Algorithm (GA) [2] has been used for solving the power system stability problems. Line stability index, L_{mn} was used to analyze the stability of the system. Particle Swarm Optimization (PSO) [3] technique was also has been used to minimize the total power losses of the system. The performance of the system was indicated by Fast Voltage Stability Index (FVSI) value. Other optimization techniques have also been used for solving the power system stability problems [4].

Evolutionary Programming (EP) technique is used in this research. In the past decade, EP techniques have been used and applied in several applications and solving many difficult optimization problems [5-6]. In this paper, EP is used as a technique to minimize the system losses. This technique determines the location of reactive power load to be injected with the system voltage act as a constraint. The range of the constraint