EVOLUTIONARY PROGRAMMING (EP) BASED OPTIMIZATION TECHNIQUE FOR VOLTAGE STABILITY IMPROVEMENT USING REACTIVE POWER DISPATCH

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ABSTRACT

This report presents an optimal reactive power dispatch based on Evolutionary Programming (EP) optimization technique for voltage stability improvement in power system. The objective of this study is to investigate the potential of reactive power dispatch (RPD) for improving the voltage stability condition along with improving the voltage profile in the system using the EP optimization technique. An EP optimization program is developed using MATLAB programming language. The objective function is to increase the voltage stability condition utilizing of a line-based index as the fitness function. A small test system is used for the implementation of this technique. The proposed optimization technique was validated on the IEEE Reliability Test System (IEEE-RTS) and result are included to realize the effectiveness of the proposed EP optimization technique.

Keyword

Evolutionary Programming, FVSI, voltage stability improvement, objective function.

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CHAPTER 1

INTRODUCTION

1.1 Background

The advancement of artificial intelligence (AI) in power system applications is widely accepted these days. AI is divided into three components namely the fuzzy logic (FL), Artificial Neural Network (ANN) and Evolutionary Computation (EC). (FL) is normally used for decision making, while the ANN and EC are used for prediction and optimization purposes respectively. Voltage instability condition was found to be a progressing issue in the modern power system network. It is found to be caused by the stressed condition in power system. Voltage stability condition is a crucial aspect in the power system operation and planning. Various techniques were reported in order to improve the voltage stability condition such as the reactive power dispatch, transformer tap changer setting, and capacitor placement on the local bus. Reactive power dispatch characterizes the amount of reactive power needed to be injected to the generator for improving the voltage stability condition [1]. Then again, the transformer tap changer setting concerned on the voltage stability improvement by altering the transmission system properties while the compensating capacitor placement technique is meant to improve the voltage profile at the local bus.

Voltage stability is defined by the System Dynamic Performance Subcommittee of the IEEE Power System Engineering Committee as being the ability of a system to maintain voltage so that when load admittance is increased, load power will increase, and so that both power and voltage are controllable [2]. The same reference defines a voltage collapse as being the process by which voltage instability leads to a very low voltage profile in a significant part of the system [3]. A voltage collapse may occur rapidly or more slowly, depending on system dynamics. It may be caused by a variety of single or multiple contingencies. These may be the sudden removal of generation or a transmission element (a transformer or a transmission line), an increase of load without an adequate