Automatic Voltage Stability Analysis In The Presence of Contingency

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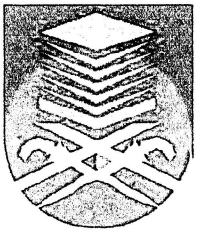

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ABSTRACT

This thesis presents an automatic voltage stability analysis in the presence of contingency. In this case, the study was conducted under generator and/ or line outage contingency. The study aims to evaluate the bifurcation point when voltage stability is highly affected by reactive power generation saturation phenomena. The reactive power generation saturation of a unit can change the system voltage immediately from stable to unstable. The value is determined using MATLAB programming that uses fast voltage stability index (*FVSI*) as an indicator. The results of the index before and after the contingency are compared to show the effect of contingency to the system. The method was tested on the IEEE 30-Bus Reliability Test System (RTS) system and results have been compared using the V-Q curves. Results obtained from study would be beneficial as future referring for researchers and students in power system.

Keywords- MATLAB, Fast Voltage Stability Index, Generator Outage, Line Outage, Voltage Stability, Voltage Collapse.

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CHAPTER 1.0

INTRODUCTION

1.1 Overview

In recent years, voltage stability has become rather important in power system. In fact, the systems are being operated close to their voltage stability limits [1]. There are some of fundamental concepts being discussed to understand how the voltage stability analysis or also known as voltage collapse problem is occurring. It is a well established fact that voltage collapse in power systems is associated with system demand increasing beyond certain limits, as well as with the lack or reactive power support in the system. This is caused by limitations in the generation or transmission of reactive power. Actually, voltage stability is defined as the characteristic for a power system to remain in state of equilibrium at normal operating conditions and to restore an acceptable state of equilibrium after a system disturbance [1]. It is important to know the meaning of the voltage stability that it concerns the ability of power system to maintain steady state acceptable voltage at all buses in the system under normal operating condition.

Generally, voltage stability consists of two categories. There are static and dynamic in nature. Fast voltage stability index (*FVSI*) is one of the equations which can be used to assess voltage stability. This method is used as a fast way of computing the index of the lines in the system. Contingencies are affected by the line outage in the system. It is also known that contingencies are one of the contributing factors to the voltage collapse. Based on the previous studies, there are many approaches towards predicting the occurrence of voltage collapse such as by using neural network or some of artificial intelligent technique such as artificial immune system (AIS). The authors in [7] studied the problem using the solution of the differential equations representing the power system as a reference to evaluate inherent approximations employed in the conventional load flow programs. In [3], the problem is analysed using the actual equilibrium point of the differential-algebraic equations (DAE) power system model.

A model for generator reactive power and voltage dynamics is incorporated in the load flow problem [4], where the generator voltage variations are accounted for in the calculation of the limits. In [2], the authors present a static model for the synchronous generators with voltage dependent reactive power limits. This generator model is included in an ordinary