VOLTAGE COLLAPSE PREDICTION BASED ON MINIMUM SINGULAR VALUE USING ARTIFICIAL NEURAL NETWORK (ANN)

Thesis is presented in partial fulfillment for the award of the Bachelor in Electrical Engineering (Hons)
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NOVEMBER 2008

ACKNOWLEDGEMENT

Firstly, Alhamdullillah I would like to wish my ‘syukur’ to Allah SWT who has given me inayah and help towards the accomplishment of my project and thesis. I am greatly indebted to Associate Professor Dr. Ismail Bin Musirin for his invaluable comments, advice and guidance in the preparation of this project and thesis.

I would like to exclaim my appreciation to those who deliberately or inadvertently assist me especially to the love of my life Nur Azah bte Md Yusof.

I would also like to express my appreciation to my beloved parents, En. Salim Bin Ali and for their prayer, passion and encouragement that has enable me to succeed. Last but not least, credits to all my friends for their ideas, suggestions and assistance in completing this project.

The support and encouragement from all the people above will always be a pleasant memory throughout my life. May God bless all of us.

ABSTRACT

Voltage stability is an important factor which needs to be taken into consideration during the planning and operation of power systems in order to avoid voltage collapse and subsequently partial or full blackout. This thesis presents the voltage collapse prediction based on minimum singular value using artificial neural network (ANN). The aim of the study is to predict the voltage collapse in a power system. These data were generated at several loading conditions. The generated data are consequently divided into training and testing data. These data were generated from the experiments performed on the IEEE 30-Bus Reliability Test System. In this study, data were generated based on repetitive load flow studies taking Minimum Singular Value (MSV) as the indicator. The Minimum Singular Value must higher than unity that will indicate a stable system.

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CHAPTER 1

INTRODUCTION

Power System stability has been recognized as an important problem for secure system operation since the 1920s [1], [2]. Many major blackouts caused by power system instability have illustrated the importance of this phenomenon [3].Historically, transient instability has been the dominant stability problem on most systems, and has been the focus of much of the industry's attention concerning system stability. As power systems have evolved through continuing growth in interconnections, use of new technologies and controls, and the increased operation in highly stressed conditions, different forms of system instability have emerged. For example, voltage stability, frequency stability and inter area oscillations have become greater concerns than in the past. A clear understanding of different types of instability and how they are interrelated is essential for the satisfactory design and operation of power systems.

Most of electric power supplies in the globe are widely interconnected, involving connections inside utilities own territories which extend to inter-utility interconnections and then to inter-regional and internal connections. This is done for economic reasons, to reduce the cost of electricity, and to improve reliability of power supply. However, as power transfer grows, the power system becomes increase more complex to operate and the system can become less secure for riding through the major outages. It may lead to large power flow with inadequate control, excessive reactive power in various parts of the system, large dynamic swings between different parts of the system and bottlenecks, and thus the full potential of transmission interconnections cannot be utilized. Power system stability issues and thermal constraints limit transmission capacity. To meet the increasing load demand and satisfy the stability and reliability criteria, either existing transmission or generation facilities must be utilized more efficiently, or new facilities 6 should be added to the systems. Given the constraints, such as lack of investment and difficulties in getting new transmission line right-of ways, the later is often difficult. The