UNIVERSITI TEKNOLOGI MARA

PERFORMANCE IMPROVEMENT IN DISTRIBUTION NETWORK WITH DISTRIBUTED GENERATION

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Thesis submitted in fulfillment of the requirements for the degree of Master of Science

Faculty of Electrical Engineering

July 2006

Abstract

Recent years, the number of distributed generation (DG) installed in distribution system has been increasing in many parts of the world. Depending on their operating characteristics and locations, distributed generation could significantly affect the voltage profile, network losses and fault level in a distribution system. This thesis describes the study of installation of distributed generation (DG) in distribution system in order on improve the system performance in terms of voltage levels, losses and system efficiency. The study involves the development of new technique for determining optimal allocation and sizing of the DG in order to minimize the losses and improves the voltage in a distribution level. Sensitivity indices based on voltage stability improvement with respect to change in injected active and reactive power at a load bus were derived and used to identify the suitable location for the distributed generation. In order to determine the optimal output of the distributed generation, an evolutionary programming optimization technique was developed with an objective to minimize the distribution losses while satisfying the voltage constraint in the system. The proposed technique was tested on 69-bus and 33-bus distribution systems and the result shown a significant reduction in distribution losses and voltage profile improvement in the system. The proposed technique was developed using the MATLAB programming software. A comparative study has also shown that distributed generation is capable of providing better voltage improvement and loss minimization than those obtained from the installation of compensating capacitor.

Acknowledgements

Praise to Allah S.W.T, The All Mighty for the blessing and mercy given onto me to complete this project.

I would like to express my gratitude to my supervisor, Assoc. Prof. Dr. Titik Khawa Bt. Abd. Rahman for her continuous guidance, advice, support, comments and kindness given towards the accomplishment of this research work and in the preparation of the thesis. Also, my appreciation and thanks to Dr. Ismail Bin Musirin as my co-supervisor for his worthy suggestion and invaluable knowledge shared with me during the project guidance. I am also indebted to Faculty of Electrical Engineering, Universiti Teknologi MARA, Malaysia for allowing me to fully utilize the necessary facilities during my studies. I would also like to thank Kolej Universiti Kejuruteraan Utara Malaysia (KUKUM) for the financial support.

Not forgotten to Assoc. Prof. Bibi Norasiqin Bt. Sheikh Rahimullah, Pn Zuhaila Bt. Mat Yasin, Pn. Hasmaini and all my friends for their support and encouragement directly or indirectly throughout my course in UiTM, who drive me towards the accomplishment of this research. I would like to take this opportunity to personally appreciate and thank the external and internal examiners; Dr. Zahrul Faizi Hussien and Assoc. Prof. Pauziah Arshad for the comments of the thesis.

Special thanks to my beloved parent, Abdul Rahim Mat Desa and Siti [illegible]asiah Syed Ramli, also to my brother, Mior Ahmad Fauzi, for their love, patience, guidance, wisdom and a great support to be the best that I can be.

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July 2006

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Rapid industrialization and population growth have resulted in an escalation in the electrical power demand. Due to limited area and slow progress in network expansion some regions have become high density load areas, for example in the urban areas. These phenomena may lead to power quality and also voltage stability issues [1]. At the same time, rural electrification networks are also experiencing poor network performance in terms of large voltage drop and high distribution losses along the lines. For these reasons, distribution utilities are trying very hard to strengthen their network and its performance. However, their effort could be hindered due to limited sources from the grid and also restricted capital investment. Introducing distributed generation (DG) to the distribution network could be an answer to these problems.

Distributed generation system is defined as any source of electrical energy interconnected to the distribution system [2]. The term distributed generation implies the used of any modular technology that sited throughout a distribution or sub transmission network to lower the cost of service. It offer valuable alternative to the traditional sources of electrical power for industrial, commercial and residential applications. The purpose of these plants is to cope with the growing demand for electricity in certain areas and render certain activities self sufficient in terms of power production thus achieving energy savings.

In recent years, distributed generation installation has shown an increasing growth in the distribution networks around the world due to the raise in promotion towards utilization of renewable energy resources and development of co-generation plants. As distributed generation is bound to effect power flow of the system associated