

ONLINE LOCATION DETERMINATION OF SWITCHED CAPACITOR  
BANK IN DISTRIBUTION SYSTEM

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A project report submitted in partial fulfilment of the  
requirements for the award of the degree of Master of  
Engineering (Electrical-Power)

Faculty of Electrical Engineering  
Universiti Teknologi Malays

JUNE 2013

*To my beloved parents*

**Jamal Sohaj, Asmaa Ismail**

*And all my Friends  
All my teachers and lectures*

*For their encouragement  
support and motivation  
through my journey of education*

## **ACKNOWLEDGEMENT**

First of all, a sincere appreciation goes to my supervisor, Prof. Dr. Mohd Wazir Mustafa for giving me the opportunity to carry out this study related to the field of power system engineering. I am highly indebted to him for his valuable thoughts and contributions towards the development of my thesis and also for providing me with an ample amount of knowledge about the field of power system engineering.

I would like to express my gratitude to Professor Afaneen Anwer Abbood, Dr. Qais Matti Alias, Dr. Jamal M. Rasool from Department of Electrical and Electronics, University of Technology, Baghdad, who encouraged and supported for continuing my study in electrical power engineering.

Lastly, I would like to thank to my family and friends for their motivation and moral support for this project report.

## **ABSTRACT**

This report describes new approaches for the determination of the direction of switched capacitor banks. It is an efficient technique for estimating the distance of switched capacitors from the monitoring location in distribution systems. At first, new indices based on branch voltage and current changes immediately after the capacitor switching instant are proposed for determining the direction of switched capacitor banks. The wavelet transform is used to detect the exact instant of switching. Mathematical analysis of a capacitor bank energizing proves that, the energized capacitor bank affects only the upstream reactive power flow and, the energizing instant, the gradients, time derivatives of voltage and current waveforms measured upstream from the capacitor location will have opposite signs bank by simply evaluating power factor changes and the signs of voltage and current waveform gradients at the switching instant. Simulation results show that the error of the estimated distance is acceptable. Signatures of shunt capacitor bank switching transient phenomena from which one can accurately determine the relative location of an energized capacitor bank whether it is upstream or downstream from the monitoring location.

## ABSTRAK

Laporan ini menerangkan pendekatan baru bagi menentukan arah bank kapasitor dihidupkan. Ia adalah satu teknik yang berkesan untuk menganggarkan jarak kapasitor dihidupkan dari lokasi pemantauan dalam sistem pengagihan. Pada mulanya, indeks baru berdasarkan voltan cawangan dan perubahan semasa serta-merta selepas segera menukar kapasitor dicadangkan bagi menentukan arah tuju bank kapasitor dihidupkan. ubahan wavelet digunakan untuk mengesan segera sebenar bertukar. Analisis matematik daripada tenaga bank kapasitor membuktikan bahawa, bank kapasitor bertenaga hanya memberi kesan kepada aliran kuasa reaktif hulu dan, segera tenaga, cerun, kebezaan masa voltan dan bentuk gelombang semasa diukur hulu dari lokasi kapasitor akan mempunyai tanda-tanda bertentangan bank dengan hanya menilai perubahan faktor kuasa dan tanda-tanda voltan dan arus gelombang kecerunan pada ketika bertukar. Keputusan simulasi menunjukkan bahawa kesilapan jarak anggaran boleh diterima. Tandatangan Shunt kapasitor bank beralih fenomena sementara yang satu tepat boleh menentukan lokasi relatif bank kapasitor bertenaga sama ada huluan atau hiliran dari lokasi pemantauan.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Overview

The growth in size of power plants and in the higher voltage equipment has divided an electric power system into three principal divisions: Generating stations, the power delivery system and the load. The power delivery system is divided into two divisions: High voltage transmission and low voltage distribution system. Transmission lines are used for transporting energy from generating stations to distribution systems. A distribution system connects all the individual loads to the transmission lines [1].

### 1.2 Problem background

Describes the determination of the direction of switched capacitor banks as well as an efficient technique for estimating the distance of switched capacitors. The position of the switched capacitor banks is determined in terms of capacitor size, proportional line impedance, and resonant frequency. Determine the location of switched capacitor banks using capacitor switching transients measured by PQM.

### **1.3 Problem Statement**

The remote control of the capacitor banks ensures that the capacitor banks can be switched on demand as the transmission system requirement dictates determine the location of switched capacitor banks using capacitor switching transients measured by PQM. Monitors and discusses the over voltages which appear on local and remote capacitor connected buses in power systems. The position of the switched capacitor banks is determined in terms of capacitor size, proportional line impedance, and resonant frequency.

### **1.4 Objectives**

To determine the importance of finding the location of switched capacitor in distribution systems and effects of this switching on power system devices and equipment. To analyze the current methods of finding switched capacitor in distribution systems based on the transient characteristics of the switched capacitor. To evaluate the fundamental signatures method for determining the switched capacitor location. To compare this method with the existing methods of tracking capacitor banks in distribution systems.

### **1.5 Significant of Project**

By analyzing capacitor transient characteristics, these kinds of transients could be identified from other transients and could be distinguished easier. Comparing different methods of switched capacitor tracking could be used to find some mixed methods based on transient characteristics of switched capacitors. After locating the switched capacitor, the severity of overvoltage will be analyzed and if it would be determined as harmful transients for power system devices or would cause disoperation of surge arresters.

## **1.6 Scope of Project**

This study is based on distribution networks To compare and evaluate different methods of tracking switched capacitor these methods has been used to locate the medium voltage switched capacitors. All evaluations and comparisons have been done on two IEEE test networks (IEEE 4 bus and IEEE 13 bus test feeders).

## **1.7 Report Outline**

Monitors and discusses the over voltages which appear on local and remote capacitor connected buses in power systems. The position of the switched capacitor banks is determined in terms of capacitor size, proportional line impedance, and resonant frequency. To analyze the current methods of finding switched capacitor in distribution systems based on the transient characteristics of the switched capacitor. To evaluate the fundamental signatures method for determining the switched capacitor location.

effect on method accuracy. Since indices are calculated using capacitor switching transients only and immediately after the switching instant.

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