

**DEVELOPMENT OF A STATE ESTIMATION
ALGORITHM FOR THE ELECTRICAL DISTRIBUTION
SYSTEM**

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Degree of Master of Science in Electrical Engineering

Department of Electrical Engineering

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DECLARATION OF THE CANDIDATE & SUPERVISOR

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters Dissertation under our supervision.

Signature of the supervisor:

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(Dr. P. S. N De Silva)

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(Dr. W. D. S. N. Rodrigo)

Signature of the supervisor:

Date

(Dr. R. Samarasinghe)

Abstract

Over the past decade, the complexity of the electrical distribution network has been significantly increased. Power flow of the network has been changed from unidirectional to a dynamic scenario with the introduction of distributed energy generators, and the network complexity has been increased with the introduction of numerous power electronic devices and the diversification of loads. In order to ensure the reliability of this complex network, it is essential to provide accurate information and feedback to the control center governing it. If the system operator knows exactly where the system stands in terms of its stability and operation, he would be able to get the best decision in any situation. This has created a demand for more sophisticated tools and equipment which aids in network monitoring and analysis in present time. Real time modeling of the network plays a vital role in achieving this.

Further, implementation of a grid wide sensor network is one of the primary requirements of a smart grid. Extraction of the exact state of the network, to create a decision support system, is impirable from building a user friendly smart grid.

This project envisages a methodology, as to how a medium scale distribution company can make use of the imperfect data from their smart meters, distribution automation devices and boundary meters to derive an accurate, real time, network status map for distribution control center operation. In this project, a statistical criterion based on the weighted least square method of power system state estimation has been used to demonstrate a successful, consistence network voltage and current estimation system, which has been developed to be the core of a practical distribution control center operation software. The network topology is directly extracted from the Geographical Information System (GIS), enabling to grab the most updated picture of this rapidly evolving system.

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List of Abbreviations

Abbreviation	Description
PUCSL	Public Utilities Commission of Sri Lanka
LECO	Lanka Electricity Company Private Limited
CEB	Ceylon Electricity Board
LV	Low Voltage
MV	Medium Voltage
GIS	Geographic Information System
RMR	Remote Meter Readings
DG	Distributed Generator