

UNIVERSITI TEKNOLOGI MARA

**OPTIMAL NETWORK
RECONFIGURATION AND
INTELLIGENT SERVICE
RESTORATION PREDICTION
TECHNIQUE BASED ON CUCKOO
SEARCH SPRING ALGORITHM**

MOHAMAD IZWAN BIN ZAINAL

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ABSTRACT

Modern distribution network is a complex network due to load demand varies and normally designed in radial circuit in which the circuit has ready to close switch at the end of the circuit when the situation needed. This switch will change the condition after distribution network triggers any abnormal during operating system. The performance of the distribution network is very important, and it is characterized by some measurable item such as voltage profile and losses, to evaluate the actual value comply with the system needs. In this research, Cuckoo Search Spring Algorithm (CSSA) is proposed to enhance the robustness of algorithm by constructing the optimal network reconfiguration consist of reducing power losses and improve voltage profile with the various loadability factor as the constraint according to load profile, based on single and multiobjective model. The performance of single and multiobjective CSSA optimization were compared to initial conditions and the value of power losses, voltage profile, number of switching involved, and convergence curve were obtained. In addition, objective function using the same CSSA algorithm were applied i.e., V_{\min} and P_{loss} as the objective function, and multi-objective involves V_{\min} and P_{loss} as the objective function. From the analysis, the multiobjective CSSA (MOCSSA) had yielded better optimal solutions with faster convergence time as compared to the other two algorithms with improvement of voltage profile and losses minimisation. Later, this MOCSSA is applied on service restoration to ensure the proposed algorithm technique is suitable in selecting the optimal switches for supply recovery after the line section is isolated from the system either by forced outage or planned outage purposes. Furthermore, the isolation line is tested on different section and load factor to recognize the improvement of optimal distribution network performance. These output data are analysed to present the optimal prediction output of service restoration using Cuckoo Search Spring – Least Square Support Vector Machine (CSS-LSSVM). Finally, a novel hybrid CSS-LSSVM was presented, and the result showed better prediction performance compared to classical LSSVM.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

The electrical power system is an infrastructure modern society and having complex interconnected network. The generation, transmission and distribution networks are major components, that delivers electricity as requested to end users. These components are differentiated with potential voltage level. The complete circuit will allow current flows, and ratings are depending to potential voltage with considering fraction on the system, called resistance.

The electrical power system, during operating contributes 13% of power loss [1]. The 80% of it, comes from distribution network [2]. Many factors affecting power loss, the loss can be neither technical nor non-technical losses. The technical losses can be related to variability of load, voltage profile, length of system conductor, and performance of load. Among these four categories, three of them will influence the condition of voltage profile and finally effecting losses value.

In the distribution network, protection initiates circuit breaker operated to isolate the faulty line, that operates within condition such as overcurrent or fault current injected into the system [3]. The faulted line is isolated from the system to prevent the damages of distribution network and contribute losses.

For the protected and isolated area, the restoration will take in place to maintain the reliability of supply. This will ensure that the source generated is utilized as forecasted, since faults is unscheduled activities.

As the scale of the distribution network increased, the number of faults also increasing. As a result, Distribution System Operator will face large numbers of faults and effect the performance of distribution network.

This research contributes the performance improvement of distribution network to choose the optimal switches and complete network reconfiguration for with and without outage proposal. Where the technique implemented on this research will identify the optimal network reconfiguration scheme and sequence to achieve the