Hybrid Metaheuristic Algorithm for Short Term Load Forecasting

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Abstract— Electric load forecasting is undeniably a demanding business due to its complexity and high nonlinearity features. It is regarded as vital in electricity industry and critical for the party of interest as it provides useful support in power system management. Despite the aforementioned situation, a reliable forecasting accuracy is essential for efficient future planning and maximize the profits of stakeholders as well. With respect to that matter, this study presents a hybrid Least Squares Support Vector Machines (LSSVM) with a rather new Swarm Intelligence (SI) algorithm namely Grey Wolf Optimizer (GWO). Act as an optimization tool for LSSVM hyper parameters, the inducing of GWO assists the LSSVM in achieving optimality, hence good generalization in forecasting can be achieved. Later, the efficiency of GWO-LSSVM is compared against three comparable hybrid algorithms namely LSSVM optimized by Artificial Bee Colony (ABC), Differential Evolution (DE) and Firefly Algorithms (FA). Findings of the study revealed that, by producing lower Root Mean Square Percentage Error (RMSPE), the GWO-LSSVM is able to outperform the identified algorithms for the data set of interest.

Keywords-Grey Wolf Optimizer, Least Squares Support Vector Machines, Load Forecasting, Metaheuristic algorithm, Optimization

I. INTRODUCTION

In today's modern lifestyle, electricity is one of the most influential energy sources that are essential in living and plays a significant role in almost every part of our routines activity. For that matter, forecasting the electricity load can be seen as one of the critical issue for various aspects in power systems and this include planning, operating, growing the security of power system, reducing operational costs for each power generation, transmission and delivery system as well. From industry perspective, an accurate and reliable forecasting would beneficial for decision making process, from the valuation, exploration to the development and production process. This is important not only for their future planning but also to reduce risk. Thus, profits can be maximized [1].

It is well documented that the relationship between load power and factors contributing load power is govern by high non linearity and complex in nature, hence makes this issue complicated to be solved. Previously, numerous methods have been demonstrated in dealing with load forecasting, from parametric models such as Autoregressive Integrated Moving Average (ARIMA) and Autoregressive Moving Average with Exogenous Input (ARMAX) [2, 3] to Computational Intelligence (CI) algorithms [4, 5].

In recent decades, CI based algorithms have been proven to be able to solve many real world practical problems and this includes in electric load forecasting [5-7]. The research on this area can be seen as a hot topic that attracted the attention of various parties and the research is actively carried on [2, 8]. In [8], a kernel based technique namely Support Vector Regression (SVR) has been proposed for electric load forecasting. In the study, the SVR is integrated with Differential Empirical Mode Decomposition (DEMD) to decompose the electric load into several parts. After the decomposition process, the proposed model is realized in electric load data of New South Wales, Australia market and the New York Independent System Operator, United States of America. Based on the findings, the proposed model is able to provide good forecasting accuracy. Focusing on load forecasting in supermarket refrigeration, [2] presents a short