別紙様式8

<div align="center">研 究 主 論 文 抄 録</div>

論文題目   Intelligent systems based short-term forecasting of prices and system demand on the wholesale electricity market
(インテリジェントシステムによる需要電力および電力価格の短期予測)

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主論文要旨
《本文》

Forecasting electricity price and load has been a common practice on the wholesale electricity market, however with deregulation importance of knowledge of possible future values of the key price and load has significantly increased. With statistical methods currently in use there is need for an expert to fine tune the output. Intelligent systems based solutions are promising, but current proposals have not provided expected reliability for them to be adopted fully.

In the first part of the study a comparative study of different training approaches for artificial neural networks (ANN) used in forecasting short-term electricity prices was performed. The second phase a combination of neural networks and fuzzy inference was proposed for forecasting both electricity prices together with system load. The input data was classified into clusters in which the variations trends show an easily discernible pattern. Based on past load and price data the cascaded ANN estimated the hourly demand and the corresponding prices quite accurately. To cater for the transition periods between one cluster and the next fuzzy inferencing was used to combine and fine tune output of the two ANN from the intersecting clusters.

In the third part of the study dynamic neural networks (DNN) have been applied in short-term forecasting of system load. Optimization of the DNN through stability analysis also ensures reliability. The stability analysis is done through calculation of Eigen values for the DNN weight matrices and the result used to guide corrective weight update. For comparison DNN based on different neural network architectures were setup for the study -feedforward network, Elman network and the radial basis function (RBF) networks.

Application of the proposed approaches has shown performance that compares favorably with existing proposals. Results for the combined forecasting of load and price have shown that detailed data clustering employed and the fuzzy based fine tuning gives a much higher forecasting accuracy. The DNN based approach has introduced stability criteria based weight adaptation that greatly improves reliability.