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THE SHORT-TERM PROGNOSIS OF THE ELECTRICAL ENERGY CONSUMPTION PROCESSES

This paper is devoted to the improvement and development of the systems analysis methodologies and prediction systems of the electrical energy consumption processes. The solution of the processes prognosis problem in the case of the signal with partially loosed and contradictory data is proposed.

Key-words -: electrical energy (EE), informational analytical systems (IAS), operative-computing complex, systems analysis, telemetry, artificial neural network (ANN)

It is necessary to make prediction of electric energy (EE) consumption to effective managing of power supplying company in the market. The traditional approaches of short-, middle-, and long- term time series prediction are based on the usage of statistical methods (i.e. spectral, variance, covariance and factor analyses, correlation methods, regression etc) [1]. The most of these methods have serious limitations: the equations that describe dependences between different factors aren't exact; it is difficult to define the criteria on the number of necessary and sufficient parameters; because of uncertainty in the input data it is difficult to define exact mathematical model of the signal; process complexity does not allow synthesis of mathematical model with necessary count of correction parameters.

Last time, in addition to known approaches of processes prediction, the methods that are based on the usage of artificial intellect become more and more popular. For example, the artificial neural networks (ANN) are used successfully in the tasks of time series prediction, signal processing, clustering, approximation, optimization and in the decision-making systems [2]. Unfortunately, the most of existent ANNs use iterative training methods. It significantly decreases possibilities to build an effective information analytical system (IAS). The EE distribution and EE consumption objects are very complex and as a consequence it is very difficult to use ANN with iterative training method to solve prediction tasks. Generally, it's because of difficulties in initial data selection. The experience in usage of new non-iterative ANN approach which is based on the 'functional on the set of tabular functions' (FSTF) method is not enough.

The problem solution of prediction accuracy improvement of electrical energy consumption when prediction is done by ANN in the case of incomplete data specification with partially contradictory information. The new effective method of incoming data repairing has been developed. It allows to repair 90-98% of lost information. This method may be used to improve prediction accuracy of ANN and statistical methods [3].

The point neighbourhood method is used to improve accuracy of the ANN prediction. This method allows to double dimension of the incoming realizations space and it improves ANN prediction accuracy by 2-3%. The new "functional on the tabular functions set" ANN method is developed. It is based on the usage of incoming realizations space expanding by k - nearest neighbourhood method. The k - nearest neighbourhoods method allows to multiply incoming realizations space by N ($N \in R$) and it allows to get enhancement of ANN prediction accuracy by 2-5%. Also this method allows to execute incoming data clusterization [4].

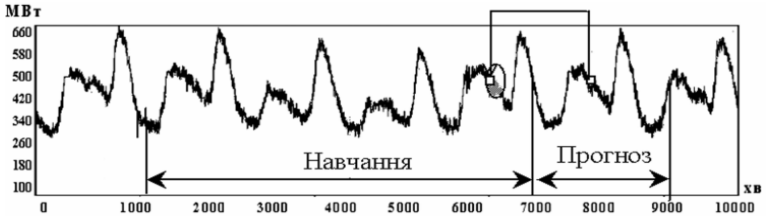

Fig.1 Creating data set using the 'point's neighbourhoods' method for the first ANN FSTF

The method for increasing entries count "functional on the tabular functions set" ANN is proposed. The

incoming data space fazification is used in this method to increase realization's space dimension. It allows to short learning sample and it allows system usage in real time. As result the accuracy of short and intermediate prediction is improved by 2-4% [5].

The IAS "Prognoz" software application is developed. And it is used in energy supporting company OSC "L'vivoblenergo". This application provides quality improvement of dispatcher's management efforts via abilities to get prediction of EE consumption in real time mode [6].

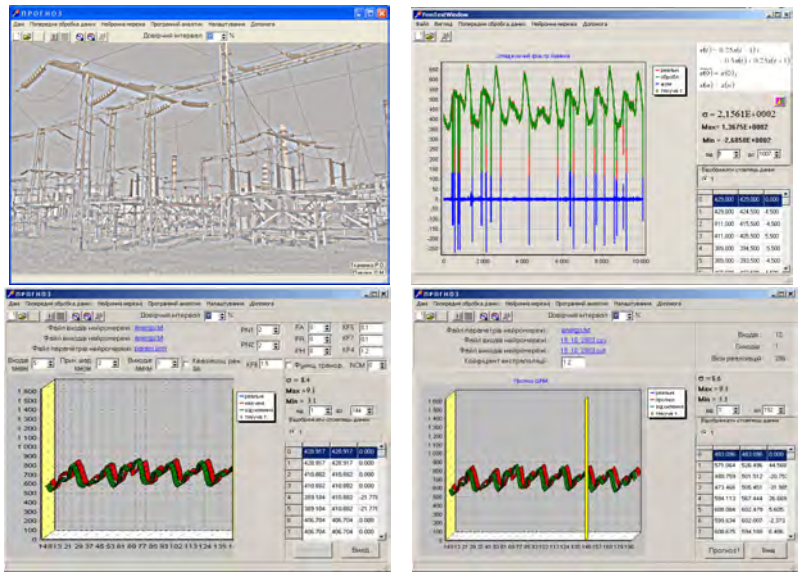

Fig.2. The main dialog windows of the IAS 'Prognoz'

Conclusion

The system analyses principles of IAS construction are adapted for tasks solution of EE consumption forecasting. These principles are based on application of neural network modeling and neural network prediction facilities. It allows accuracy improvement of short- and intermediate forecasting by 30-50% and 20-30% accordingly. Also it allows to execute prediction in real time.

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