

Linear Autoregression with Random Coefficients Based on the GMDH in Conditions of Quasirepeated Observations

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Abstract. *For modelling in a class of autoregression equations with random coefficients the criterion of regularity with dividing of observation sample on training and testing subsamples is offered. Existence of the optimal set of regressors is proved. The condition of a reduction of the optimal autoregression equation is obtained. This condition depends on parameters of model and volumes of samples. The optimum reduced model will have a smaller mistake of forecasting of output variable on new samples of observations in comparison with model constructed on true structure.*

Keywords

structural uncertainty, criterion of regulatory.

1 Introduction

Definition of the order autoregression model in conditions of structural uncertainty by quantity and structure of regressors is the important problem in the theory of identification, and for its decision there are various approaches.

2 Theoretical Part

This problem is one of objects of research in the Group Method of Data Handling (GMDH) [1–7], which was developed by academician NAS of Ukraine A.G. Ivakhnenko. The approach is based on dividing of sample of observations into training and testing parts: on training sample coefficients of model are estimated, and on testing sample quality of model is estimated. According to principles of modelling in the GMDH to construct autoregressive equation of optimum complexity, it is necessary:

- a) to specify a method estimation coefficients in autoregressive equation;
- b) to set algorithm of generating of autoregressive equations (structures of models);
- c) to develop external criterion for an estimation of quality of touched structures;
- d) to investigate behaviour of a population mean of external criterion depending on structure regressors;
- e) to prove existence of autoregressive model of optimum complexity.

At modelling in a class of autoregressive equations in the GMDH the criterion of regularity is applied traditionally: training sample is formed by the first part of time series, and testing sample is formed by the second part. Application of criterion of a regularity in such kind demands the control as dynamic properties of object can be shown unequally on different phases of transients.

The criterion of regularity in the so-called scheme of quasirepeated observations, which is possible in conditions of active experiment, is offered. In this scheme training and testing samples are received by special way as pair realizations of functioning of object with close entry conditions, qualitatively identical character of transients and close conditions during the final moments of time.

In [8] iterative procedure of parametrical identification for system autoregressive equations with random coefficients is developed. These results are used for estimation unknown population means of coefficients for a case of one-dimensional regression.

3 Conclusion

The behaviour of criterion of the regularity in the conditions quasirepeated observations is investigated depending on structure of regressors. The condition of a reduction of the optimum autoregression model is obtained. This condition depends on parameters of autoregression model and volumes of samples. The optimum reduced model will have a smaller mistake of forecasting of output variable on new samples of observations in comparison with model constructed on true structure.

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