Analysis and identification of one class of systems with distributed random parameters

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Control of distributed systems is a complex problem that requires the construction of adequate mathematical models, including models, which take into account the effects of random factors. This article describes the method of statistical analysis of systems with distributed parameters in the Goursat problem statement and the method of parametric identification in the context of the definitions of the statistical characteristics of random parameters of these systems. Both methods are based on the use of the so-called projection models, which are the result of a projection approximation of the original continuous models, described by partial differential equations with random coefficients. This approximation is performed using the operational matrices. The key point is the analytical procedure of averaging stochastic system operator based on the approximate representation of that operator in the form of the matrix series. In result the averaged projection model of system with distributed random parameters is obtained. The problem of identification of unknown statistical characteristics of the random parameters of the mathematical model is reduced to the minimization of a quadratic functional, calculated using the averaged projection model. Example of solving the problem of identification of mean value and variance of a random parameter of stochastic system is considered. Using the averaged projection models allows building effective computational algorithms for solving problems of statistical analysis and parametric identification. These algorithms are suitable for parallel implementation.

Keywords: *distributed parameters, statistical analysis, random parameters, stochastic system, identification, mathematical model, projective approximation, matrix operator.*

REFERENCES

[1] Tikhonov A.N., Samarsky A.A. *Uravneniya matematicheskoy fiziki* [Equations of mathematical physics]. Moscow, Nauka Publ., 2004, 743 p.

[2] Pupkov K.A., Egupov N.D., Makarenkov A.M., Trofimov A.I. *Teoriya i kompyuternye metody issledovaniya stokhasticheskikh system* [Theory and Computer Methods of Study of Stochastic Systems]. Moscow, Fizmatlit, 2003, 400 p.

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