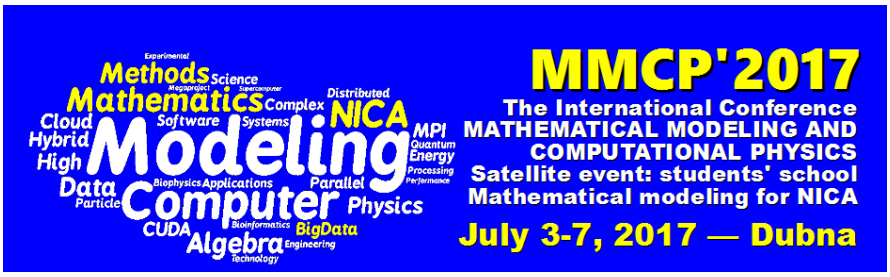

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Modern approaches to synthesis, stability analysis and verification of nonlinear stochastic models of natural science

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The modern approaches to the nonlinear stochastic models synthesis, stability analysis and verification are characterized in the current work. One of the approaches is related to the self-consistent stochastic models constructing technique. Based on this technique, the interaction schemes are constructed that includes the symbolic record of the possible interactions between the system elements. Then, using the system state operators and the state change operator, the stochastic models structure is described and the transition to the corresponding Fokker–Planck vector equation is performed, and the rules for the transition to the multidimensional stochastic differential equation in Langevin form are formulated. The specified approach allows us to estimate the influence of the stochastic injection on the properties of the models [1]. For the models under study, it is possible to carry out a numerical experiment with the application of the developed software package that allows us to solve the stochastic differential equations systems taking into account the features of the described transition from the deterministic case to the stochastic case. The second approach is based on the transition from the deterministic description of the model to the stochastic description and on the principle of the stability problem reduction of the differential inclusion solutions to the stability problem for other types of the equations [2, 3]. In the framework of this approach, the usual, fuzzy and stochastic Lyapunov functions are applied and from the unified point of view the stability properties of the solutions of differential inclusions, fuzzy and stochastic differential equations are studied. For obtaining the stability conditions, we use both the properties of Lyapunov functions and the divergence properties of the vector fields determined by the right-hand sides of the differential equations [4]. Based on the combination of the specified approaches, nonlinear mathematical models of the populations interactions are constructed and studied [5, 6]. The results can be used in the modeling problems of the various classes of stochastic systems, and also for comparing the qualitative properties of the natural science and technics models in deterministic and stochastic cases.

Short biography note

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