REPORT

on the scientific and scientific-organizational activities of the Department of Computer Technologies and Mathematical Statistics for the first half of 2023 of the Institute of Mathematics and Mechanics Ministry of Science and Education of the Republic of Azerbaijan

About scientific activity

During the reporting period, the Department of Computer Technologies and Mathematical Statistics carried out research work on the topic "Algorithms for visual control of dynamic production processes and the study of some issues of probability theory" and 5 works were completed.

The department has 11 employees. Among them, 1 is a doctor of science, 4 is a doctor of philosophy, 4 is a software engineer, and 2 are laboratory assistants. The department has two doctoral students.

The staff of the department published 10 scientific papers, 2 of which are scientific articles, 8 are abstracts of conferences.

About individual works

Work 1: Statement and solution of the "model-object" synchronization problem for indirect measurement of the phase coordinates of the dehydrogenation process based on a mathematical model.

Executer: Ph.D. in Engineering, Associate Professor H. A. Nagiev, Head of Department

The peculiarity of the parametric identification of mathematical models of dynamic control objects manifests itself in the fact that here it is not enough to achieve the required reproduction accuracy relative to the state space, but dynamic accuracy must certainly be ensured, i.e. synchronization of two evolutions "model-object" in time sequence. In solving real-time control problems, the synchronization factor becomes even more important, since the error in the time

shift, obviously, has the property of accumulation. Since the sequence of discrete steps of the numerical solution of differential equations determines the time coordinate of the model, this coordinate must ultimately reflect the real astronomical time. The question arises of bringing these two measurements to the same scale and constant correction of deviations. The task was set to create a system for computer monitoring and simulation modeling control, which should provide synchronization under conditions of external influences, which, as a rule, have a significant impact on the rate of relaxation in dynamic objects. Obviously, even under the assumption of ideal parametric identification, external influences not taken into account will cause a temporal discrepancy, and the development of special algorithms for tracking the time scale is necessary here.

Thus, the development of an unambiguous system of guarantees that provides a given accuracy between real astronomical time and a sequence of step lengths for the numerical solution of equations is the main direction of our research. The task is formulated mathematically, and a working algorithm is created from the class of tracking systems. The working capabilities of the algorithm have been tested on a simple example, and at the next stage, studies will be carried out, and the results will be sent to print in the form of a scientific article. During the reporting period, 1 article, 2 abstracts were published and 1 abstract was submitted for publication.

Work 2: Study of multitype migration branching stochastic processes.

Executer: doct. ph.m.s.,prof.sen.r.a. Aliyev Soltan A.

In the reporting period, a new model of branching random processes was considered. In the model under consideration, the particles in the system, in contrast to the particles in the traditional model, have a certain random "lifetime" and at the end of their life they undergo reproduction and transformation. The probabilistic characteristics of such processes are investigated and an integral equation for the generating function of the process is obtained. During the reporting period, 1 article, 3 abstracts were published, 1 article, 2 abstracts were submitted for publication.

Work 3: Probabilistic characteristics of the flow of events with prolonging dead time

Executer: c.ph.math.sci., senior researcher N. J. Jafarov

The characteristic of the flow of events with an extended dead time is studied. An article is being prepared on this topic.

Work 4: Boundary value problems for the Markov random walks describes by the generalization of utoreqressive process of order one AR(1)

Executer: c.ph.m.s,.lead.r.a. Ibadova Irade A.

In this work we proved boundary value problems for Markov random walks describe by the generalization autoregression process of order one. A limit theorem for the first crossing momend of the nonlinear boundary by random walks is proved. 1 articles, 3 conference materials were published.

Work 5: Study of linear boundary value problems for Markov random walks described by autoregressive processes with random coefficients.

Executer: phd in math.,chief.r.a. Khalilov Vuqar S.

Studying the law of large numbers for Markov random walks described by the autoregressive process AR(1). The results obtained are reflected in 1 thesis and 1 article is published.

About scientific and organizational activity

On May 4-5, 2023, H. Nagiev took part in the scientific conference "Space technologies in Azerbaijan and the genius of Heydar Aliyev", dedicated to the 100th anniversary of the birth of the national leader of the Azerbaijani people Heydar Aliyev, held at the National Aerospace Agency.

All employees of the department took an active part in the International Conference dedicated to the 100th anniversary of the national leader Heydar Aliyev, organized by our institute.

Tairova Ainur is responsible for the design and technical support of the official pages of the Institute on YouTube and Facebook. Along with this, she was a member of the organizing committee, which was engaged in the reception and discussion of abstracts. She also solved other design issues of holding the International Conference dedicated to the 100th anniversary of national leader Heydar Aliyev, held by the Institute.

Musaeva Taira is the technical editor of the scientific journals of the Institute "Izvestia of ANAS" (mathematical issue) and "Izvestia".

Our employees supervised 15 students of the Faculty of Information Technology and Management of ASOIU under the undergraduate program, who underwent research and production practice at our Institute. The training and practical activities of interns on all days of the week were carried out by our employees with the provision of control and evaluation of progress. The thematic direction of the practice was "Design and programming of structural queries of management software for queuing enterprises".

H. Nagiyev is engaged in teaching under the bachelor's and master's programs at ASOIU and our Institute.

Doctor of Philosophy in Engineering,

Associate Professor   **Hasan Nagiyev**