

REPORT

on the scientific and scientific-organizational activities of the Department of Computer Technologies and Mathematical Statistics for the first half of 2022 of the Institute of Mathematics and Mechanics of ANAS

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 7 scientific papers, 3 of which are scientific articles (one Scopus work), 4 are abstracts of conferences. In addition, 1 article was accepted for publication, 1 article was submitted for publication, and 1 abstract was accepted for participation in the conference.

About individual works

Work 1: Development of an optimal control strategy in a limited time interval for a motor fuel hydrotreater operating on feedstock with a variable sulfur content.

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

The equations of chemical kinetics of a motor fuel hydrotreater operating on variable sour raw materials consist of differential equations of mass balance and heat balance. The mass balance is based on the rate of change in the amount of matter, and the heat balance is based on the rate of change in the amount of heat.

The following issue has been resolved on the development of an optimal strategy for managing a hydrotreating unit in a limited time interval:

- The software for the "man-machine" control interface has been developed and a simulation model has been developed for visual control of the process. The results obtained were accepted by the editors of the journal "Statistics & Probability Letters" with an impact factor, and the next article was sent to a conference in Ufa, Russia.

Work 2: Limit theorems for migration of branching random processes with uninterrupted parameters.

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

In many issues of science and technology, it is interesting and of great importance to use branching processes as an important and relevant mathematical model. In this regard, the study of migratory branching stochastic processes with continuous parameters (the presence of external interference other than the multiplication of particles in the system) is very important. During the reporting period, processes of this type were studied and limit theorems were obtained. 2 articles, 3 abstracts were printed and 1 article, 1 abstract were sent for printing.

Work 3: Reduction of boundary value problems for equations of parabolic type of the second order with truncated coefficients to integral equations and their solution by numerical methods.

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

In the second formulation with truncated coefficients for parabolic equations in a cylindrical domain, using the potential of a 2-layer layer, the boundary value problem was reduced to the Fredholm integral equation in x and the Voltaire-type integral equation in t and was solved numerically using approximation. The work is being prepared for publication.

Work 4: Limit theorems for a Markov random walk described by generalized first-order autoregressive processes.

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

Boundary value problems for Markov random walks described by generalized autoregressive processes are studied and the central limit theorem is proved. 2 articles, 4 abstracts were printed and 1 article, 1 abstract were sent for printing.

Work 5: Studied boundary value problems for random walks associated with autoregressive processes.

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

Limit theorems are proved for the moment when branching processes reach a high level. Published 1 article, 3 theses.

About scientific and organizational activity

Among several areas of cooperation between the National Aerospace Agency of the Ministry of Defense Industry (NAKA) and the Institute of Mathematics and Mechanics of ANAS, work was carried out in the following areas:

- Preparation of guidelines for expanding and modernizing the functionality of the UAV.

Based on the information received from the UAV in this direction, the issues of providing navigation were investigated. A mathematical method is proposed for the optimal choice of the height of photographing when controlling uneven sections of the relief. Based on the method, terrain irregularities are determined from photographic images and the flight altitude is output to the UAV control system. The article has been prepared for publication in the scientific journal Vesti NAKA.

Also, as part of this cooperation, on March 2, 2022, the staff of the Institute, Professor El Khan Abbasov and Associate Professor Gasan Nagiyev, took part in the conference "Training qualified personnel for the defense industry: an innovative approach to integrating scientific research and education."

On every day of the week, 15 students of the Faculty of Information Technology and Management of ASOIU took place in the department of online

work practice under the bachelor's program, under the guidance of the department's employees. Intern students were divided into 3 groups in each of which the internship was conducted on the following topic:

- Compilation and programming of structural requests for management software of queuing enterprises;
- Creation of software for managing queuing enterprises in the Python/Django environment;
- Methods for solving mathematical and physical equations in the Matlab system.

**Doctor of Philosophy in Engineering,
Associate Professor**

Hasan Nagiyev