

**AZERBAIJAN NATIONAL ACADEMY OF SCIENCES**

**INSTITUTE OF MATHEMATICS AND MECHANICS**

*Annual report on the scientific and scientific-organizational activities of the Department  
"Wave dynamics" in 2020*

During the reporting period, the Department will have 8 scientific papers on the topic "Study of vibrations of mesh structures and plates on articulated supports». The Department has 9 employees. 8 of them are engaged in scientific work. In 2020, 8 articles were submitted for publication, 4 articles were published, and 3 articles were accepted for publication. Published 7 articles in foreign journals. Two of the presented articles were published in the journal Impact Factor, Scopus Index (Springer).

**WORK A:** Discharge waves in a cylindrical net.

**Doct.phys.math.sci.prof. Agalarov J.H.**

The equations of motion of a cylindrical network are given on the basis of General equations of motion of the network. Questions of this kind are of practical interest in flexible drill pipes and well flushing. In this paper, we studied the discharge waves in a cylindrical setconsisting of nonlinear elastic fibers. In PRand longitudinal motion, such a setand solutions change depending on the nature of the movement. Thus, when an infinite network is compressed, continuous waves are formed during compression, especially Riemann waves. The problem was solved using the characteristics method under specified conditions. The results are presented and represented in graphical form.

The following articles were published during the reporting period:

1. Agalarov, J.H., Mamedova, G.A. & Gasanova, T.J. Unloading wave in a cylindrical net. Mechanics of Solids Springer Journals, Scopus, vol.54 (2019), №8, p.1138–1143, 2020, <https://doi.org/10.3103/S0025654419080028>
2. J.H. Agalarov, M.A. Rustamova, T.J.Hasanova "The propagation of nonlinear waves in a structure consisting of cylindric net system". Caspian Journal of Applied Mathematics, Ecology and Economics V. 8, No 1, 2020, July, ISSN 1560-4055
3. J. G. Agalarov, G. A. Mammadova "Free vibrations of suspended concentric plates" East European Science Journal (East European Scientific Journal), Poland, RSCI, ISSN: 2468-5380, Cosmos Impact Factor-4.464, no. 62, p. 17-23, 2020

**WORK B.** A class of homogeneous solutions of new types of plane elastodynamic problems.

**Doct.phys.math., sci, sen.res.ass Rasulova N. B.**

The discussed issue of the reporting year was devoted to finding a class of homogeneous solutions to the wave equation and discovering its properties.

In General, this class of solutions greatly simplifies the process of solving plane elastodynamics problems, since some popular solutions, such as Broberg and Lamb, were obtained in an elementary way.

These solutions also led to the definition of a new type of functional invariant solutions Simirnova - Sobolev.

These and some other dynamic issues are planned to be studied in the reporting year.

During the reporting period, 1 article was published.

1. **Rasulova N. B., Rasulov M. B. A new class of homogeneous solutions for plane elastodynamic problem, ISSN 0025-6544, Mechanics of Solids, 2020, Vol. 55, No. 7, pp. 139–143, DOI: 10.3103/S0025654420070171**

**Social event:**

**Rasulova N. B., member of the expert Council of the higher attestation Commission.**

**WORK D:** Investigation of the application of the generalized Kanyar-Hoop method to three-dimensional dynamics.

**Can. of phys. and math. sciences, leading researcher. Rasulov M. B.**

The main goal of this paper is to approximate the solution of three - dimensional problems of elastodynamics to one - or two-dimensional problems. So far, this problem has been solved in the class of homogeneous solutions, which is the basis for work on this topic in the reporting year. This goal was achieved by applying the generalized Kanyar-Hoop method and a class of homogeneous solutions of a new order of a new type obtained by the author himself. At the next stage, the application of this method for solving specific problems will be studied.

During the reporting period, 1 article was published.

1. **Rasulova N. B., Rasulov M. B. A new class of homogeneous solutions for plane elastodynamic problem, ISSN 0025-6544, Mechanics of Solids, 2020, Vol. 55, No. 7, pp. 139–143, DOI: 10.3103/S0025654420070171**

**Public activity:** Participation in seminars of the Institute and Department.

**WORK E:** Study of waves propagating along a flat grid.

**Candidate of physical and mathematical Sciences, leading researcher. Rustamova M. A.**

Based on the equations of motion of the grid, the equations of motion of the grid in the plane are constructed. It is taken into account that the mesh consists of elastic fibers. The

problem is solved for solutions stretched along the edges of the grid when cellular sections occur. The resulting ejection waves were then examined. It was found that if the edges of the grid are pulled out and left after that, then transverse waves will form here. The problem is solved by the method of characteristics under appropriate conditions. The results are presented in reports and graphs. The following articles were prepared for publication during the reporting period.

1. J.H. Agalarov, M.A. Rustamova, T.J.Hasanova “The propagation of nonlinear waves in a structure consisting of cylindrical net system”. Caspian Journal of Applied Mathematics, Ecology and Economics V. 8, No 1, 2020, July, ISSN 1560-4055
2. M.A. Rustamova Investigation of free vibrations of a reinforced cylindrical shell filled with liquid. Solid state mechanics (ed. Russian Academy of Sciences. MTT) (Accepted for printing)

**Public activities:** Participation in seminars of the Institute and Department.

**Pedagogical activity:** Teaches at the Department of "Mechanics" of the Azerbaijan University of architecture and construction.

**Work F:** Free fluctuations on the basis of Winkler from a circular mass of elastic for fastening of plates.

**Candidate of physical and mathematical Sciences, leading researcher. Mammadova G. A.**

The paper considers the question of free vibrations on the Winkler basis of a round plate with elastic attachment. Depending on the conditions of attachment and elasticity, vibrations on the plates were studied in the presence of a support. In particular, in order to find the properties of Winkler-based oscillation, that is, in one case the solution was solved using the Bessel function, and in the other, the Kelvin function. The hardness of the quenching is calculated as a function of frequency. The problem is solved by the inverse method. Reports were made on various parameter prices and charts were set.

The following articles were published during the reporting period.

1. Agalarov, J.H., Mamedova, G.A. & Gasanova, T.J. Unloading wave in a cylindrical net. Mechanics of Solids Springer Journals, Scopus, vol.54, №8, p.1138–1143, (2019)2020, <https://doi.org/10.3103/S0025654419080028>
2. J. G. Agalarov, G. A. Mammadova "Free vibrations of suspended concentric plates" East European Science Journal (Scientific Journal), Poland, RSCI, ISSN: 2468-5380, Cosmos Impact Factor-4.464, no. 62, p. 17-23, 2020

**Public activities:** Participation in seminars of the Institute and Department.

**Pedagogical activity:** Teaches at the Department of "Mechanics" of the Azerbaijan University of architecture and construction.

WORK L. Investigation of the Central crack problem in layered orthotropic type II materials.

**candidate of physical and mathematical Sciences, with th.n.with Aliev I. Y.**

In this case, the problem of destruction of layered composite materials of type II with an outer rim is investigated. In this case, orthotropic materials of type II are taken as materials in the composite. The surface tension applied to the crack boundaries was studied. The problem is symmetrical, there are no stresses at infinity. The offsets are lost. The solution of the problem is reduced to the Fredholm type II integral equation. The coefficient of tension intensity is determined.

**Public activity:** Participation in seminars of the Institute and Department.

**WORK N:** Axisymmetric vibrations of an infinitely long cylindrical orthotropic shell in contact with an infinitely elastic medium and filled with a liquid.

**Can. of phys. and math. sciences, Seyfullayev F. A.**

In solving the problem, we used the theory of coatings, the system of equations of motion of elasticity theory, the equations of motion of an ideal two-phase viscoelastic liquid, and the properties of Bessel functions.

The study of asymmetric and axisymmetric forced and free vibrations of a cylindrical coating modeled as an orthotropic coating in contact with the environment consists in studying the influence of physical and geometric parameters that characterize the environment on certain oscillation frequencies.

Published 1 article on this topic.

F.A.Seyfullayev, Ş.A.Kərimova Spatially-three-dimensional statement of the problem of hydrothermodynamics of reservoirs, Aktual elm, 2020

**Public activities:** Participation in seminars of the Institute and Department.

**Public activities:** Chairman of the Council of young scientists.

**Teaching activity:** Azerbaijan University of architecture and construction

**WORK M:** Investigation of frequency characteristics of a viscoelastic plate loaded with a liquid.

**Doct.phys.math.sci.prof. Zamanov A.D.**

Social event:

Member of editorial Board of international scientific journal "Mechanics of composite materials", published in Riga in Russian and English in new York, International Scientific Journal of Mechanics and Mechanical Engineering, Theoretical and Applied Mechanics, Diploma in University News of a series of pedagogical-psychological Sciences), Deputy editor-

in-chief of journals, actual problems of musical science, culture and education, Deputy Chairman of the editorial Board of the journals of ICT in education, history, man and society, member of the editorial Board of the Azerbaijan school magazine. I am the scientific editor of the two-volume collection "Materials of the XXII Republican scientific conference of doctoral students and young researchers" "Teacher inspires creativity".

I headed the organizing Committee of about 10 international and national scientific conferences held in Azerbaijan. Currently , I am supervising the dissertation work of three doctoral students (E. Agasiev, A. Karimova, G. Alekperova). E. Agasiev (in the specialty of mechanics of deformable solid bodies) and A. Karimova (in the specialty of methods of teaching mathematics) have completed and discussed their dissertations.

**Scientific activity:**

Currently, he directs the dissertation work of two doctoral students (E. Agasieva, G. Alekperova).

**ABOUT THE SOCIAL ACTIVITIES**

1. 1. doctor of physical and mathematical Sciences Rasulova N. B.

Works on the expert Council Higher attestation commission.

2. **Candidate of physical and mathematical Sciences** Rustamova M. A.

She teaches at the Azerbaijan University of architecture and construction.

3. **Candidate of physical and mathematical Sciences** Mamedova, G. A.

She teaches at the Azerbaijan University of architecture and construction.

4 **Candidate of physical and mathematical Sciences** Seifullaev F. A.

He teaches at the Azerbaijan University of architecture and construction.

**Head of the Doct. phys. math.sci.,**

**“Wave Dynamics” department**

**prof. Aqalarov J.H.**