

**AZERBAIJAN NATIONAL ACADEMY OF SCIENCES**  
**INSTITUTE OF MATHEMATICS AND MECHANICS**

Annual report on the activities of the scientific and scientific- organizational of the  
department "Wave dynamics" in 2022

During the reporting period, the department conducts research on 8 scientific papers on the topic “ **Dynamics of fixed net and inhomogeneous bodies, the study of free oscillations of the layer** . Currently, the department has 7 employees. 6 of them are engaged in scientific work. In 2022, 7 articles were sent for publication, 5 articles and 1 thesis were published, 2 articles were accepted for publication.

**WORK A.: A study of the change in the compression ratio of internal combustion engines .**

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

The change in the parameters of internal combustion engines (depending on pressure and volume) was calculated for two different speeds of rotation of the gear wheel (2000 rpm and 4000 rpm). It is shown that a large pressure drop with an increase in speed also causes a decrease in the efficiency. In the future, it is planned to report with an increase in the compression ratio.

During the reporting period, the following articles were submitted for publication.

- 1. J.H.Agalarov, T.J.Gasanova On the effectiveness of regulation of the degree of compression of the internal combustion engine, Izvestia of higher educational institutions. Engineering. 6(747) 2022. DOI: 10.18698/0536-1044-2022-6-3-10, p.3-10**

2. **Agalarov J. G., Mamedova G. A., Rustamova M. A.** The wave Investigations in a supported network. Construction mechanics of engineering structures and constructions. 2022. T.18. No. 3. C269–279. <http://doi.org/10.22363/1815-5235-2022-18-3-269-279>

**Social activities:** Participation in seminars of the institute and department.

**WORK B. Dynamics of an elastic half-space containing a cylinder.**

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

The scientific work presented in the reporting year is devoted to the dynamics of bodies consisting of mixed media. In particular, we studied the unsteady dynamics of a structure in which a cylinder made of another elastic material is inserted into an elastic half-space. The issue has been resolved by a specially developed technique, and the process ended with the constructions of graphs of some quantities values.

The following article was sent to press during the reporting period.

1. **N.B. Rasulova, T.M. Mahmudzade. Solution of the Lamé dynamic problem. Mechanic of Solids. (Izv. RAN. MTT)**
2. **N.B. Rasulova, T.M. Mahmudzade. The propagation of non-stationary waves in a half space with a built-in cylinder. Modern Problems of Mathematics and Mechanics. Proceedings of the International scientific conference devoted to the 110-th anniversary of academician Ibrahim Ibrahimov.**

**Social activities:** Participation in seminars of the institute and department.

Rasulova N.B., works in the expert council of the Higher Attestation Commission.

**WORK D: The problem of propagation of non-stationary waves in closed spaces.**

**Candidate of Physical and Mathematical Sciences, Leading Researcher Rasulov M.B.**

One of the methods used in solving problems of elastodynamics is the integral transformation method, and one of the difficulties that currently arise is the implementation of the inverse transformation. Therefore, the search for new methods remains an urgent problem. In the work performed in the Laplace-Fourier integral transform, only functions with a change of parameter were used, and the possibility of replacing special differential equations with algebraic equations was proved.

As an example, the solution of the problem of elastodynamics, which has not yet been exactly solved, is shown.

During the reporting period, 1 article was published.

1. **Rasulov M.V., Mirzoeva G.R. Solve problems on the propagation of non-stationary waves in limited areas. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mechanics, 41 (8), 48-51, (2021).**

**Social activities:** Participation in seminars of the institute and department.

#### **WORK E: Dynamics of a Cylindrical Net with Mass**

**Candidate of Physical and Mathematical Sciences, Leading Researcher  
Rustamova M.A.**

In this paper, we consider the motion of a semi-infinite cylindrical net with a load attached to its end. It is assumed that the cylindrical mesh is in a state of tension. After a certain time, the load is released, and the load begins to move along with the grid. At this time, the intensity of the waves generated in the grid should be determined. It is assumed that the mesh retains its original cylindrical state due to some kind of supports. To solve the problem, the grid motion equations and boundary conditions are given.

The problem is solved by the method of characteristics. The results are displayed in the form of reports and graphs.

During the reporting period, the following articles were prepared for publication.

- 1. Rustamova M.A. Determination of natural vibration frequencies of a reinforced cylindrical shell. Structural mechanics of engineering structures and buildings, 2021. 17(6). 628–638**

**Social activities:** Participation in seminars of the institute and department.

**Pedagogical activity:** Conducts pedagogical activity at BSU.

**Work F : Movement of a reinforced planar net with mass**

**Candidate of Physical and Mathematical Sciences, Leading Researcher  
Mamedova G.A.**

In this paper, the behavior of a reinforced net with a fixed mass is considered. The reinforced mesh with a load at the end is in a taut state. At a certain moment, the load is released and the load begins to move along with the grid. Waves appear in the grid, it is necessary to determine their intensity. The equation of motion for the prestressed reinforced web is written so that the motion can be studied.

The solution is established by fulfilling the conditions at the point of contact between the mesh and the load. The method of characteristics solves the problem of propagation of evanescent waves

The goal is to study waves in a massively reinforced rigid flat mesh.

The following article was sent to press during the reporting period.

**1. Agalarov J. G., Mamedova G. A., Rustamova M. A. The wave Investigations in a supported network. Construction mechanics of engineering structures and constructions. 2022. T.18. No. 3. C269–279.  
<http://doi.org/10.22363/1815-5235-2022-18-3-269-279>**

**Social activities:** Participation in seminars of the institute and department.

**Pedagogical activity:** Conducts pedagogical activity at BSU.

**WORK L. Investigation of the problem of a central crack located in type II layered orthotropic materials**

**Candidate of Physical and Mathematical Sciences, S.Sc. with . Aliev I.Yu.**

In this paper, we study the problem of a central crack located in type II layered orthotropic materials. The material has an edge crack. The solution of the problem is reduced to singular integral equations. The edge intensity factor is located at the crack tip. The influence of the geometric and physical parameters of the object on the tension coefficient has been studied.

**Social activities:** participation in seminars of the institute and the department

**WORK N. Vibrations of a transversely supported cylindrical shell in a liquid medium.**

**Candidate of Physical and Mathematical Sciences, Leading Researcher Seyfullayev F.A.**

The problem of forced vibrations of round cylindrical coatings reinforced with initial rods with a medium is studied, the influence of reinforcement with initial rods and forced vibrations of the medium on the amplitude and frequency of vibrations is determined. To solve the problem, a system of equations of motion in displacements of the theory of coatings, elasticity theory, equations of motion of an ideal two-phase viscoelastic fluid, properties of Bessel functions were used.

I'm dealing with a message about a specific application issue.

The work done during the year is reflected in the following article.

- 1. Seyfullayev F.A., Musaev C.E. Axially-Symmetric form of lateral vibration of a non-homogenous cylindrical shell lying on viscoelastic foundation. Актуальная наука, 2022, № 2(49), с. 7-12.**

**Social activities:** participation in seminars of the institute and the department

**Pedagogical activity:** AzMIU (Azerbaijan University of Architecture and Construction)

**WORK M:**

**doctor of physical and mathematical Sciences Zamanov A.D.**

### **ABOUT THE SOCIAL ACTIVITIES**

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

“Wave Dynamics” department

Doct. phys. math.sci.,dos. Rasulova N.B.