Semi-annual report of "Mechanics of deformable solids" department of IMM of Ministry of Science and Education for 2024

Scientific direction: Fluid, gas and deformable solid mechanics

Subject: Mathematical modeling of destruction of deformable bodies.

In "Mechanics of deformable solids" department work 14 collaborators:

1. Talybly Latif Khalil oglu – head of department;
2. Aliyev Gabil Garibkhan oglu – chief research associate;
3. Mirzazadeh Irada Hatam kizi – leading research associate;
4. Mir-Salim-zade Minavar Vagif kizi – leading research associate;
5. Mammadova Mehriban Ali kizi – leading research associate;
6. Nagiyeva Nigar Miryashar kizi – leading research associate;
7. Bagirov Emin Telman oglu – senior research associate;
8. Huseynov Fuad Sahib oglu – research associate;
9. Mammadova Hijran Ali kizi – senior research associate;
10. Muradova Ayten Gadim kizi – research associate;
11. Rzayeva Vusala Bayazkhan kizi – junior research associate;
12. Mammadov Isgandar Gudrat oglu – engineer;
13. Allahverdiyeva Sema Asif kizi – senior laboratory assistant;
14. Abbasova Arzu Feyyaz kizi − senior laboratory assistant.

11 of these are research associates and 2 senior laboratory and an engineer. According to the research plan of 2024 in the department were carried out research on the topic "Mathematical modeling of destruction of deformable bodies". The plan provided for 10 works on the subject. Scientific works are carried out according to the plan.

I. Scientific activity

Work: Determination of the analytical relation connecting the functions g1/2 and g2 included in the approximation method used in solving the problem of A.A. Ilyushin's theory of viscoelasticity

Executor: doct.ph.math.sci., prof. L.Kh.Talybly, ress.ass., A.G.Muradova

One of the efficient methods of solving quasi-static problems of visco-elasticity theory is the so-called approximation method developed by A.A. Ilyushin. As a result of applying this method, Ilyushin's the je-beta functions are

included in the solution of the problem. As a result of applying this method, Ilyushin's same-beta functions are included in the solution of the problem. The solution to a specific problem in the theory of viscoelasticity involves the use of two je-beta functions. The author of the method, Alexey Antonovich Ilyushin, proposed determining the je-beta functions on the basis of experimental data. The author of the method, Alexey Antonovich Ilyushin, proposed determining the je-beta functions on the basis of experimental data. At the same time, the analytical expressions of these functions remained undefined. Later, analytical expressions for both functions were determined by prof., Latif Talybly. In this research work, for the first time, the interconnection of these functions with each other has been established and a mathematical connection has been obtained that expresses one through the other.

Work: Longitudinal-radial vibration of a thick-walled pipe with variable mass taking into account the physical-chemical change of its material
Executor: doct.ph.math.sci., prof. G.G.Aliyev

The issue of longitudinal-radial oscillation of a thick-walled polymer pipe located in an aggressive liquid environment is solved by taking into account the influence of changes in its mass and the physico-chemical properties of the pipe material. To study the problems of mechanics of polymers operating in an aggressive fluid environment, a generalized Hooke's law is proposed, taking into account the influence of an aggressive fluid environment.

Work: Application of artificial intelligence theory to the diagnosis of poisoning with toxic substances.
Executor: cand.ph.m.s., lead.re.ass. I.H. Mirzazadeh

Possible options for applying the theory of artificial intelligence to the diagnosis of poisoning with toxic substances are proposed.

Work: On a modeling method of the stressed state of bodies with physical-nonlinear deformation of Rabotnov-Moskvitin type viscoelastic properties
Executor: cand.ph.m.s., lead.re.ass. M.A.Mammadova

The defining equations of Y.N.Rabotnov-V.V.Moskvit type physical-nonlinearly deformable viscoelastic bodies characterize viscoelastic bodies with geometrically similar creeping curves. A mathematical problem for determining the state of stress and deformation in these bodies, is given. A method has been developed that reduces the solution of this problem to the solution of the problem of the theory of elasticity and plasticity under active loading.

Work: Inverse problem of dispersion mechanics for a fixed perforated plate
Executor: cand.ph.m.s., lead.re.ass. M.V.Mirsalimzade

The fixed perforated plate is stretched by an axisymmetric unknown force acting at infinity. It is assumed that the plate is scattered from the edges of the hole in the direction perpendicular to the direction of the tensile force. The value of the force that ensures the destruction of the plate in this way is determined. A mathematical formulation of the problem is given and its solution is carried out.

Work: Dispersion of axisymmetric waves propagating in a prestressed highly elastic plate in bilateral contact with a liquid.
Executor: sen.res.ass. E.T.Bagirov

The problem of dispersion of axisymmetric waves propagating in a stressed elastic plate in two-way contact with a liquid was posed and the solution of the problem was obtained by numerical methods. A large number of graphs were constructed and qualitative analysis was carried out.

Work: Stability of a transversally isotropic spherical shell under the influence of pressure distributed over its surface
Executor: research associate Huseynov F.S.

A spherical shell with transversally isotropic elastic properties is considered. A regularly distributed pressure acts on the surface of the shell. A mathematical formulation of the problem of stability of the considered sphere is given. The solution method is selected. The issue is being resolved. The main goal is to investigate the problem and determine the magnitude of displacements and stresses caused by an external load.

Work: Mathematical modeling of elastico-plastic deformation of the wedge.
Executor: sen.res.ass. N.M. Nagiyeva

The problem of elastic-plastic deformation of a wedge under the action of a concentrated force acting on its top along the axis of symmetry is solved.

A.A. Ilyushin's equations of small elastic plastic deformation theory are used as solving equations. The value of the concentrated force causing plastic deformation is determined. At the same time, relations were obtained that make it possible to determine the areas of elastic and plastic deformation of the wedge.

Work: Corrosion destruction of an elastic-plastically deformable ball.
Executor: res.ass. H.A.Mammadova

For the first time in the literature, the issue of corrosion destruction of an elastico-plastic deformable body (in this case, a balloon) is presented. The ball is hollow, the material is perfectly elastico-plastic. A ball filled with an aggressive environment inside is under internal pressure. It is believed that the speed of the corrosion process in the ball depends on the stressed state of the ball and the amount of corrosion damage accumulated at the time of inspection. The problem of corrosion destruction is set and as a result of the solution, the time and coordinates of corrosion destruction of the ball under consideration are found.

Work: Study of vibrations of a shell reinforced with shafts and rings with soil
Executor: jun.ress.ass. Rzayeva V.B.

The vibrations of a cylindrical shell reinforced with shafts and rings in contact with soil, are studied asymptotically.

II. Scientific organizational activity

Members of the department were published 19 scientific works – 9 papers, and 10 theses. One paper was published in a journal included in the Science Citation Index Expanded database. In addition, 5 (five) papers were accepted for publication. Employees of the department G.G.Aliyev, L.Kh.Talybly, I.H.Mirzazadeh, M.A.Mammadova, E.T.Bagirov, N.M.Nagiyeva, H.A.Mammadova, A.G.Muradova, V.B.Rzayeva will make scientific reports at the XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" dedicated to the memory of the brilliant Azerbaijani scientist and thinker of the XIII century Nasireddin Tusi.

Associate Professor M.A.Mammadova made scientific reports at the VII International Multidisciplinary Scientific Congress (March 5-6, 2024, Ankara, Turkey), associate professor M.V.Mirsalimzade at the 25th conference "Current problems of construction and the construction industry" (Tula, June 26-28, 2024), junior researcher V.B.Rzayev at the international scientific and practical conference "Modern problems of construction", held in Azerbaijan (Baku, November 24, 2023).

Graduate students of the Faculty of Mechanics and Mathematics (February-March) and the Faculty of Applied Mathematics (April-May) of the Baku State University completed a scientific internship at our department.

Every Friday, a seminar on deformable solids is held in the department.

Head of the Department **doct.phys.math.sci., prof., L.Kh.Talybly**