

**Semi-annual report of “Mechanics of deformable solids”
department of IMM of Ministry of Science and Education
for 2023**

Scientific direction: Fluid, gas and deformable solid mechanics

Subject: Mathematical modeling of destruction of deformable bodies.

In “Mechanics of deformable solids” department work 10 collaborators:

1. Talybly Latif Khalil – head of department
2. Mir-Salim-zade Minavar Vagif – leading research associate
3. Mammadova Mehriban Ali – leading research associate
4. Bagirov Emin Telman – senior research associate
5. Nagiyeva Nigar Miryashar – senior research associate
6. Mammadova Hijran Ali – research associate
7. Muradova Ayten Gadim – junior research associate
8. Mammadov Isgandar Gudrat – engineer
9. Bagirova Sema Asif – senior laboratory assistant
10. Rzayeva Vusala Bayazkhan – senior laboratory assistant

7 of these (six) are research associates and 2 (two) senior laboratory and an engineer. According to the research plan of 2023 in the department were carried out research on the topic " Mathematical modeling of destruction of deformable bodies ". The plan provided for six works on the subject. Scientific works are carried out according to the plan.

I. Scientific activity

Work: On one refinement in mathematical modeling of the processes of deformation and destruction of viscoelastic bodies.

Executor: doct.ph.math.sci., prof. L.Kh.Talybly

On the basis of experimental data published in the literature, mathematical modeling of the processes of deformation and destruction of viscoelastic bodies was carried out on the basis of a theory newly created by the author. The areas of deformation and destruction are divided into four subregions. The defining equations corresponding to each region are written down. A new concept, the damage condition, has been introduced into the literature, and its mathematical expression has been written. The introduced damage condition predicts the time of

formation of the first damage in a viscoelastic body. Instead, a new failure condition is defined, which makes it possible to predict the failure time of the structure.

The following scientific works have been published:

1. Cyclic bending and delayed fracture of bars of viscoelasticplastic material // Azerbaijan University of Architecture and Construction, Engineering Mechanics Scientific and Technical Journal, September 2022, Issue 12 Volume 4 Number 3, pages 32-4 (Mammadov M.A.).
2. On one mathematical model of characteristics of corrosion strength of materials // Международнойнаучно-практическийжурнал, Endless Lightin Science, 20 January 2023, p.305-309. (Mammadov X.A.).
3. Solution of the viscoelastic boundary value problem for a rotating disk / Modern Problems of Mathematics and Mechanics“ of the International Conference dedicated to the 100th anniversary of the National Leader Heydar Aliyev, Baku, 26-28 April 2023, p.389-391.

Work: On the method of modeling the stress state of bodies with viscoelastic properties under physical-linear deformation.

Executor: cand.ph.m.s., lead.re.ass. M.A.Mammadova

A new method of mathematical modeling of the stress state of physical non-linearly deformable viscoelastic bodies of the V. V. Moskvitin type is proposed.

The following scientific works have been published:

1. The solution of the problem of cycle loading of hereditary elasticoplastic ball at pulsating internal pressure // Proceedings Book International Conference on Engineering Science, Azerbaijan Technical University, november 11-12, 2022, Baku, p.386-392
2. Напряженно-деформированное состояние наследственно упругопластического шара при пульсирующем внутреннем давлении// Международной научно-практический журнал, Endless Light in Science, 17 Декабря, 2022 с.175-181
3. Исследование изгибных колебаний вязкоповреждающегося стержня при отсутствии эффекта залечивания дефектов // Bakı universitetinin xəbərləri, Fizika-riyaziyyat elmləri seriyası, №4, 2022, s.47-56
4. Solution of the problem of the long durability of hollow shaft at torsion with the account of its damageability / Modern Problems of Mathematics and Mechanics“ of the International Conference dedicated to the 100th anniversary of the National Leader Heydar Aliyev, Baku, 26-28 April 2023, p.251-252

5. Delayed fracture of bars of viscoelasticplastic material on cyclic bending / XI. ULUSLARARASIAVRASYA UYGULAMALI BİLİMLER KONGRESİ, 27-28 Mayıs 2023, Ankara, p.2

Work: The problem of minimizing a stringer plate weakened by a system of periodic holes.

Executor: cand.ph.m.s., lead.re.ass. M.V.Mirsalimzade

The problem of minimizing an infinite plate with stringers with periodic holes made of an elastically deformable material is solved.

Work: On the dispersion of axisymmetric waves propagating in a prestressed elastic plate immersed in a compressible fluid.

Executor: sen.res.ass. E.T.Bagirov

The problem of scattering of axisymmetric waves propagating on an elastic plate stressed in a compressible fluid is posed, and the solution of the problem is obtained by numerical methods.

The following scientific works have been published:

1. On the influence of finite initial strains of the plate made of highly elastic material and loaded by the compressible inviscid fluid on the dispersion of the axisymmetric waves propagating in this plate // Journal of Baku Engineering University, Mechanical and Industrial Engineering, 2022, Vol.6, Number 1, p.22-35
2. Dispersion of axisymmetric quasi-scholte waves in the pre-strained highly elastic plate loaded by compressible inviscid fluid // Azerbaijan University of Architecture and Construction, Scientific and Technical Journal on “Engineering Mechanics”, Iss.12, Vol. 4, No. 3, Sep. 2022, p.42-55
3. On the influence of the residual stresses arising from the contact of the cut on the dispersion of axisymmetric longitudinal waves in the two-layer hollow cylinder / Modern Problems of Mathematics and Mechanics“ of the International Conference dedicated to the 100th anniversary of the National Leader Heydar Aliyev. Baku, 26-28 April , 2023, p. 136 – 138

Work: Mathematical modeling of fatigue failure of an elastic plastic deformable wedge

Executor: sen.res.ass. N.M.Nagiyeva

A mathematical formulation of the problem of fatigue failure of an elastic ideal plastically deformable wedge is given. Determine the number of repetitions of the force acting on the wedge.

The following scientific works have been published:

1. Об определении числа циклов нагружения до разрушения оси автомобиля / «Современные проблемы математики и механики» Международной конференции, посвященной 100-летию общенационального лидера Гейдара Алиева. Баку, 26-28 апреля 2023 года, стр. 308-309.

Work: Mathematical model of the characteristics of the process of corrosion destruction.

Executor: res.ass. H.A.Mammadova

A function is proposed that characterizes the process of corrosion destruction of the "metal-aggressive environment" system.

The following scientific works have been published:

1. Формула, позволяющая определить коррозию под напряжением // Журнал Бакинского Инженерного Университета - Машиностроение И Промышленность, 2022. Том 6, Выпуск 2, с.122-126

2. Об определении времени до коррозионного разрушения при нестационарных изменениях потенциала / «Современные проблемы математики и механики» Международной конференции, посвященной 100-летию общенационального лидера Гейдара Алиева. Баку, 26-28 апреля 2023 года, стр.250

Work: Mathematical modeling of the stress state of a composite pipe of a viscoelastic material.

Executor: jun.re.ass. A.G. Muradova.

The problem of determining the stress-strain state of a viscoelastic composite pipe is formulated mathematically. The problem was solved by A. A. Ilyushin's approximation method.

Work: Asymptotic study of oscillations of a cylindrical shell in contact with a solid medium reinforced with shafts

Executor: senior laboratory assistant V.B. Rzayeva

Oscillations of a cylindrical shell in contact with a solid medium reinforced with shafts are asymptotically investigated.

1. Исследование свободных колебаний неоднородного цилиндрического покрытия, армированного неоднородными кольцами, в жидкости / XXXIV Международный научный симпозиум «От 20 января до Карабахской победы», 28 января 2023 г., с.248-251

2. Свободные колебания неоднородной контактирующей с жидкостью оболочки, укрепленной неоднородными стержнями / Современные проблемы математики и механики» Международной конференции, посвященной 100-летию общенационального лидера Гейдара Алиева. Баку, 26-28 апреля 2023 г., стр. 341-343.

II. Scientific organizational activity

Members of the department were published 16 scientific works – 8 papers, and 8 theses.

Employees of the department (L.Kh.Talybly, M.A.Mammadova, E.T.Bagirov, N.M.Nagiyeva, H.A.Mammadova, V.B.Rzayeva) made various scientific reports at the international conference dedicated to the 100th anniversary of the national leader Heydar Aliyev. M.A. Mamedova, V.B. Rzayeva presented their scientific works at the conferences held in Turkey (Ankara).

L. Kh. Talybli was the chairman of the final examination committee of the bachelor's degree in mechanics at the Baku State University.

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