

## **Annual report of “Creeping theory” department of IMM ANAS for 2019**

In “Creeping theory” department work 7 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. Mammadova Hijran Ali – research associate
5. Bagirov Emin Telman – research associate
6. Nagiyeva Nigar Miryashar – research associate
7. Bagirova Sema Asif – senior laboratory assistant

6 of these (six) are research associates and 1 (one) senior laboratory assistant. According to the research plan of 2019 in the department were carried out research on the topic "Variable load of bodies of irreversible deformation". The plan provided for six works on the subject. Scientific works were carried out according to the plan.

### **I. Scientific activity**

**Work:** Phenomenological method for determining the increasing thickness of ice on the surface of an airship while flying

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

A mathematical method has been created on the surface of the aircrafts to evolve the spatial evolution of the icing process during the flight. The ability of the proposed method is illustrated by the experimental data on GLC-305 aerodynamic wing leak, published by other authors in the literature.

The result was compiled as a paper and submitted to the journal for publication.

Following works were published in 2019.

1. Л.Х.Талыблы, Х.А.Мамедова. О прогнозировании времени до коррозионного разрушения при нестационарной концентрации диффундирующего вещества // Деформация и разрушение материалов, №2, 2019, с.9-12. **Scopus**

2. L H Talibly, F B Imranov , A M Jafarova. Predicting the time of corrosion damage to a plate with a deep double-sided external undercut under stretching // IOP Conference Series: Materials Science and Engineering 570 (2019) 012100 IOP Publishing doi:10.1088/1757-899X/570/1/012100. **imp.f. 0.38, Scopus**
3. Latif H. Talibly. The criterion of non-stationary cyclic fatigue of bodies, taking into account the presence of an incubation period of destruction // IOP Conf. Series: Materials Science and Engineering 570 (2019) 012099 IOP Publishing doi:10.1088/1757-899X/570/1/012099. **imp.f. 0.38, Scopus**
4. Talybly L.Kh. The method of solution of general quasistatic problem of the linear viscoelasticity theory and its application / International Conference "Modern Problem of Mathematics and Mechanics" devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, p.477-478

**Work:** Balanced longitudinal vibrations of a viscous damaging stick taking into account secondary effects.

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

The mathematical formulation of the problem was given, the solution of method was chosen. The frequency of the stick dances examined as a result of the solution was determined. Special cases were investigated, the graphics have been established.

1. Mehriban A.Mamedova. The solution of a problem on stationary axial vibrations of a finite length hereditary elastic annular cylindrical shell // IOSR Journal of Engineering, vol.9, issue 5, may 2019, p.9-13.
2. Mammadova M.A. Diffused distruction of a spherical vessel under internal pressure // IOSR Journal of Mechanical and Civil Engineering, vol.16, issue 3 ser.I, 2019, p.56-61. **Imp.f. 3.781**
3. Mammadovamehriban Ali Kizi. Determination of inverse creep of infinite hereditarily elastoplastic plate with hole after instantaneous removal of internal pressure // Journal of Engineering Research and Application, vol.8, issue 11(part I) Nov.2018. p.38-42 **imp.fac. 5.179**
4. M.A.Mamedova. The solution of problem of determination os stress-strain state of a circular viscoelastic beam with semi-circular longitudinal neck at torsion / International Conference "Modern Problem of Mathematics and Mechanics" devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, p.342-343
5. M.A.Mamedova. Solution of a viscous-elastic problem of a circular plate loaded with moment along the inner contour / Akademik Azad Mirzəcanzadənin 90 illik yubileyinə həsr olunan beynəlxalq konfrans, Bakı, 2018, 13-14 dekabr, s.64

**Work:** Partial closure of straight cracks from the circular hole outline on the stringer plate

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

Plate strengthened by stringer has a flat crack that protrudes from the circular hole outline. The plate is subjected to compression deformation. It is the issue of partial closure of the crack. Firstly, the mathematical formulation of the problem is given. The laws of elasticity theory (Hooke's law) were used. Tensions and deformations around the crack were identified. Then, using tension conditions, a tension is applied which results in partial closure of the hole. Important cases have been investigated.

1. Mir-Salim-zade M.V. Minimization of the Stressed State of a Stringer Plate with a Hole and Rectilinear Cracks // Journal of Mechanical Engineering, 2019, vol. 22, no. 2, pp. 59-69
2. Мир-Салим-заде М.В. Моделирование закрытия периодической системы щелей в перфорированной стрингерной пластине / XX Межд. научно-техн. конф. «Актуальные проблемы строительства, строительной индустрии и архитектуры», Тула, 28-29 июня 2019 г, с. 202-204
3. Определение равнопрочной формы отверстия для стрингерной пластины, ослабленной прямолинейными трещинами / VIII Межд. конф. «Деформация и разрушение материалов и наноматериалов», Москва, 19-22 ноября, 2019

**Work:** The dependence of the average stress of a prismatic bar bending in an aggressive environment on the concentration of the medium

**Executor:** res.ass., H.A.Mammadova

Mechanical characteristic of the prismatic bar expressed by the Hooke's law is bent in an aggressive medium. Depending on the concentration of the aggressive medium, the average tension in the bar during bending is determined. The time of corrosive failure in the bending deformation in the aggressive medium considered later has been found.

1. Л.Х.Талыблы, Х.А.Мамедова. О прогнозировании времени до коррозионного разрушения при нестационарной концентрации диффундирующего вещества // Деформация и разрушение материалов, №2, 2019, с.9-12 **Scopus**
2. H.A.Mammadova. Corrosive failure of thick-walled pipe under the action of torque / International Conference "Modern Problem of Mathematics and Mechanics" devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, p.347-348

**Work:** The stress-strain state of a viscoelastic cylinder in an infinite medium under the action of internal pressure

**Executor:** res.ass., E.T.Bagirov

Visco-elastic cylinder, surrounded by an infinitely ideal plastic environment, is deformed under internal pressure. The issue is the contact issue of elasticity. It is thought that the cylinder and the external environment are connected in the form of hard contact. Mathematical representation of the problem is given. First of all, the appropriate elastic problem has been solved. The solution of the elastic problem solved using the solution of the elastic problem. The issue is completely solved.

1. E.T.Bagirov, S.D.Akbarov. Axisymmetric longitudinal wave dispersion in a bi-layered circular cylinder with inhomogeneous initial stresses // Journal of Sound and Vibration, Volume 450, 23 June 2019, Pages 1-27, **Imp.f. 3.123 Elsevier**
2. Emin T. Bagirov., Surkay D. Akbarov., Muslum Ozisik. Dynamics of the Moving Ring Load Acting in the System “Hollow Cylinder + Surrounding Medium” with Inhomogeneous Initial Stresses // CMC: Computers, Materials & Continua, Vol. 61, No. 2, pp.503-534, **Imp. Fac. 3.024, “Web of Sciences”, “Scopus”**
3. Forced Vibration of the Non-Homogeneously Pre-Stressed System Consisting of the Hollow Cylinder and Surrounding Medium // CMES: Computer Modeling in Engineering & Sciences, Vol. 121, No. 1, 2019 ,p.315-348, **Imp.f. 0,796, “Web of Sciences”, “Scopus”**
4. E.T.Bagirov., S.D.Akbarov. Forced Vibration of The “Hollow Cylinder + Surrounding Medium” System with Inhomogeneous Initial Stresses / International Conference “Modern Problem of Mathematics and Mechanics” devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, p.72-73
5. E.Bagirov. The influence of of inhomogeneous initial stresses onthe dispersion of axisymmetric longitudinal wave propagating in the hollow cylinder / 21.Ulusal Mekanik Kongresi, Niğde Ömer Halisdemir Üniversitesi, Türkiyə, 02-06 Sentyabr, 2019

**Work:** Fatigue of the bar with a narrow rectangular cross-section with pulsating torsion.

**Executor:** res.ass., N.M.Nagiyeva

The solution of the problem is carried out in three stages. First of all (at the first stage) the problem of elasticplastic torsion from the initial state of the tooth is solved. A.A.Ilyusin’s small plastic deformation theory of elastic relations were used. In the second stage, the problem of elasticplastic deformation of the pulse is

solved; as a result, the analytical formulas for residual voltages and deformations in the bar were obtained. The residual deformation is determined by the residual deformation intensity. After that, the damage has been arranged and the failure occurred, has been appointed as the number of deformation torsions.

1. Нагиева Н.М., Мовсумова А,Х., Мирзоева Б,Д. О поперечном колебании экспоненциально неоднородно анизотропной прямоугольной пластинки, лежащей на вязкоупругом основании // Актуальная наука, №4 (21), 2019, с.31-35

2. Нагиева Н.М. Циклическая прочность призматического бруса овального поперечного сечения при знакопеременном кручении // Тяжелое машиностроение, 2019, №9, с.33-36

3. N.M.Nagiyeva. On lateral vibrations of exponentially inhomogeneous anisotropic rectangular plate lying on viscoelastic foundation / International Conference “Modern Problem of Mathematics and Mechanics” devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, p.405-407

## **II. Scientific organizational activity**

IV course students of Mechanics-mathematics faculty of Baku State University Naftaliyeva Hijran, Tagiyeva Zeynab, Shirinli Shahnaz, Khalilov Elmar did practical work in “Creeping theory” department on 18 february-29 march, 2019. The head of the practice was cand.ph.m.s., lead.re.ass. M.A.Mammadova. Students were informed about the scientific research work carried out in the department. It is noted that the department conducts the scientific research works in 4 directions: the first: deformation and destruction of constructions hereditarily (visco) elastic, elastico-plastic, elastico-viscoplastical materials. The forms of load-monotonic, cyclic, arbitrary. The second: irregular wave spectrial theories, in conformity to sea wave. The third: corrosion deformation under strain and corrosion tiredness destruction of constructions, which are worked out in aggressive medium. The fourth: stochastically problems of deformation and destruction of construction, subjected to random loads.

Research works in the department has attracted a great deal of interest to students in science.

Members of the department were published 21 scientific works - 12 papers and 9 theses. 11 paper were submitted for publication. There were 18 references to scientific works of department employees.

L.Kh.Talybly, M.A.Mammadova, H.A.Mammadova, E.T.Bagirov and N.M.Nagiyeva took an active part in an International Conference “Modern Problems of Mathematics and Mechanics” devoted to the 60<sup>th</sup> anniversary of the Institute of Mathematics and Mechanics and made scientific reports.

Head of the department Latif Khalil oglu Talybly is a member of Academic Council and editorial staff of the journal “Proc.of IMM”. At the same time, he is a reviewer of “International Journal of fatigue” (Elsevier), “Simulation Modeling Practice and Theory” journals.

At the department's seminar, the assistant professor of Kazan State University (Russian Federation) Linar Sabitov discussed his doctoral thesis on mechanics.

Every Friday in the department held a seminar.

**Head of Department**  
**L.Kh.Talybly**

**doct.phys.math.sci., prof.,**