

I. QUESTIONNAIRE OF THE INSTITUTE AS A WHOLE

1. General information

1.1. Structure, main tasks and organizational and legal form

The S.P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine (hereinafter referred to as the Institute) is a state-owned, non-profit scientific Institute under the jurisdiction of the National Academy of Sciences of Ukraine (NASU). Established on November 30, 1918, concurrently with the founding of the NASU, the Institute has a long-standing history of advancing scientific knowledge.

As of the end of 2023, the Institute comprises 11 scientific departments, a postgraduate program, the editorial office of the scientific journal "Applied Mechanics," and various support units. These include a scientific and technical library, accounting and reporting department, planning and economic department, personnel department, administrative office, technical department, economic department, warehouse, metrological service, labor protection service, and fire safety service. Additionally, the Institute oversees the State Enterprise "Pilot Production of the S.P. Timoshenko Institute of Mechanics of the NASU," which is currently in the process of liquidation as per NASU Presidium Resolution No. 144, dated March 22, 2023.

The Institute operates in accordance with the Constitution of Ukraine, the Law of Ukraine "On Scientific and Scientific-Technical Activities," other relevant legislative acts, the Statute of the NASU, and the Basic Principles of Organization and Activities of a Scientific Institute of the NASU, as well as the Institute's own Statute. Its primary mission is to conduct scientific research aimed at acquiring and applying new knowledge in applied mathematics, particularly in the areas of continuum mechanics, theoretical mechanics, mechanics of deformable solids, fluid and gas mechanics, mechanics of structural and advanced composite materials, interactions of bodies with their environment and various physical and mechanical fields, and oscillation theory. The Institute also focuses on translating scientific and technical knowledge into practical applications, training highly qualified researchers, and contributing to the social, economic, and cultural needs and innovative development of the country.

1.2. Organizational structure

The Institute is governed by its Directorate, which includes the director (or acting director), an advisor to the directorate, a deputy director for research, a scientific secretary, a deputy director for general affairs, the chief engineer, and an assistant director. The administrative structure within the scientific departments comprises heads of departments, deputy heads (in departments with a sufficient number of employees), and scientific secretaries of departments (these positions do not hold official status). The State Enterprise "Pilot Production of the S.P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine" is currently overseen by the chairman of the commission responsible for the termination of the enterprise.

1.3. Documents related to the organizational structure

The Statute of the Institute is available on the official State Register website at <https://usr.minjust.gov.ua/ua/freesearch>, and a copy can also be accessed on the Institute's website at <http://inmech.kyiv.ua/l/ua/regulations/>.

During the reporting period, the organizational structure of the Institute underwent changes. Following the death of the Head of the Department of Mechanics of Stochastic Inhomogeneous Media, Corresponding Member of the NASU L.P. Khoroshun, and due to the inability to secure management with a qualified specialist (Doctor of Sciences), along with the department's small size, the Department was dissolved effective April 1, 2020. This decision was

based on the resolution of the Scientific Council of the Institute (Protocol No. 3 dated March 3, 2020), and its staff members were reassigned to other departments within the Institute (Order No. 14-K dated March 11, 2020).

In 2023, in response to the Institute's proposal and as part of an effort to optimize the business entities of the NASU, the State Enterprise "Pilot Production of the S.P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine" was liquidated, as per the Resolution of the Presidium of the NASU No. 144 dated March 22, 2023. From June 2023, the enterprise's employees were dismissed in accordance with Ukrainian legislation, and the company was managed by a liquidation commission. Its immovable property was transferred to the Institute's balance sheet. Preparations are currently underway for the completion of the liquidation balance sheet of the State Enterprise "Pilot Production of the S.P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine."

1.4. Information on the staff of the Institute

The Institute's staff experienced minor changes during the review period. The total number of employees increased by 7.4%, with the number of researchers growing by 12.6%. Researchers comprise more than 80% of the total employees. In the scientific divisions, seven departments have ten or more employees, while four departments have fewer than ten. Including scientists who collaborate on a voluntary basis—mainly former employees who have moved to other Institutes in Ukraine, commercial enterprises, or abroad—the number of researchers in each department exceeds ten.

The average age of the Institute's researchers is relatively high. Due to constraints on remuneration and the demanding nature of scientific work, which requires dedication throughout university, graduate studies, and professional careers, few graduates are inclined to pursue scientific work, especially in mechanics. Moreover, the quality of university training in mechanics is declining, disrupting the natural process of staff renewal and leading to an increasing average age of employees.

However, efforts to attract younger scientists between 2021 and 2023 through competitions for scientific positions and postdoc training programs have had a positive impact. As a result, the average age of doctors of sciences decreased by 4.3% in 2023, from 72.5 years to 69.4 years, while the average age of candidates of sciences fell by 3.1%, from 54.7 years to 53.0 years, compared to the highest average ages recorded during the reporting period.

1.4.1. Number of employees involved in the implementation of research (including part-time employees)

№ Salary	Staff of the Institute	Number, persons							Structure of human resources at the end of the last reporting year	
		2017	2018	2019	2020	2021	2022	2023		
1.	Employees involved in the implementation of R&D, total (<i>sum of lines 2 + 3 + 4</i>)	135	141	140	139	139	143	145	100 %	X
including:										
2.	Researchers * (except doctoral and postgraduate students) (<i>sum of lines 2.1 – 2.14</i>)	103	106	106	105	105	110	116	80,0 %	100%
Of these, by position**:										
2.1	Director	1	1	1	1	1	1	1	X	0,9%
2.2	Deputy Directors	1	1	1	1	1	-	1	X	0,9%
2.3	Academic Secretary	1	1	1	1	1	1	1	X	0,9%
2.4	Advisors to the Directorate of the Institute						1	1	X	0,9%
2.5	Heads of scientific departments, scientific publishers, editorial offices of scientific publications	10	10	10	10	10	9	9	X	7,8%
2.6	Deputy(s) of the Head/Head							6	X	5,2%
2.7	Principal Researchers	8	8	8	8	6	4	4	X	3,4%
2.8	Leading Researchers	18	21	22	22	22	23	25	X	21,6%

2.9	Senior Research Fellows	31	31	32	33	34	39	39	X	33,6%
2.10	Research Fellows	8	7	7	5	6	7	6	X	5,2%
2.11	Junior Research Fellows	6	5	5	5	5	6	4	X	3,4%
2.12	Engineers/Technologists	10	10	10	10	10	10	11	X	9,5%
2.13	Leading Engineers/Technologists	8	8	8	7	7	8	7	X	6,0%
2.14	Leading scientific editor of a scientific publishing house, a periodical scientific publication	1	3	1	2	2	1	1	X	0,9%
2.15	Doctoral students***	4	4	0	1	0	0	1	X	0,9%
2.16	PhD students***	7	4	7	6	6	1	5	X	4,3%
3.	Technique	10	10	10	10	10	9	10	6,9%	X
4.	Support Staff	22	25	24	24	24	24	19	13,1%	X
5.	Employees involved in the implementation of research work, part-time	6	6	8	8	7	12	17		X
5.1	in % of the total number of employees involved in the implementation of research (line 5/line 1)	4,4%	4,2%	5,7%	5,8%	5,0%	8,4%	11,7%		X
6.	Employees who work on a public basis	27	37	37	36	36	32	28		X
7.	Employees who are on a long-term	2	2	2	2	2	2	2		X

internship abroad, etc.									
-------------------------	--	--	--	--	--	--	--	--	--

1.4.2. Number of researchers of the Institute (including part-time employees) by academic degrees and academic title (at the end of the reporting period)

Researchers	Quantity <i>Persons</i>	% of the total number of employees R&D performers
Academicians of the National Academy of Sciences of Ukraine	5	3,4
Corresponding Members of the NASU	4	2,8
Academicians of National Branch Academies of Sciences of Ukraine		
Corresponding Members of the National Branch Academies of Sciences of Ukraine		
Members of foreign academies of sciences	18	12,4
With an academic title	61	42,1
Without academic title	55	37,9
With a scientific degree	90	62,1
Without a degree	26	17,9

1.4.3. Number of researchers by gender and degree (including part-time employees)

Years	Number of researchers			of them have a scientific degree					
	Just	<i>including Women</i>		Doctor of Science			Ph.D. (Ph.D.)		
		Persons	in % of the total number	Just	<i>including Women</i>		Just	<i>including Women</i>	
					Persons	in % of the total number		Persons	in % of the total number
2017	103	47	45,6	43	5	11,6	43	22	51,2
2018	106	44	41,5	44	5	11,4	39	21	53,8
2019_	106	44	41,5	46	5	10,9	40	22	55,0
2020	105	43	41,0	45	4	8,9	37	21	56,8
2021	105	43	41,0	44	4	9,1	38	21	55,3
2022	110	46	41,8	41	5	12,2	44	23	52,3
2023	116	49	42,2	44	5	11,4	46	24	52,2
Changes	+13	+6		+1	0		+3	+1	

1.4.4. Average age of researchers

Years	Researchers	who have a scientific degree
-------	-------------	------------------------------

		Doctor of Science	Ph.D. (Ph.D.)
2017	60,0	69,5	51,8
2018	61,4	70,6	53,0
2019	61,8	69,3	54,7
2020	62,4	70,2	54,3
2021	62,2	70,2	53,7
2022	62,0	72,5	53,0
2023	60,7	69,4	53,0
Changes	+0,7	-0,1	+1,2

Institutional Councils

The management of the Institute is conducted in accordance with the Law of Ukraine "On Scientific and Scientific-Technical Activities," the Statute of the NASU, the Basic Principles, and the Statute of the Institute.

The Academic Council of the Institute serves as a collegial body responsible for overseeing the scientific and scientific-technical activities of the Institute, specifically within the scope of exclusive powers defined in paragraph 4.21 of the Statute. The Council also performs advisory functions on other scientific and technical matters. The current composition of the Academic Council is available [here](#).

The Institute also hosts a Council of Young Scientists, with its members listed [here](#). The current Chairman is Oleksandr Ostos, Ph.D., a Senior Researcher in the Department of Oscillation Theory.

From 2017 to 2021, the Institute had a specialized academic council, D 26.166.01, which concluded its mandate in 2021. During its tenure, the council oversaw the successful defense of five doctoral theses and nine PhD theses. Additionally, the one-time council DF 26.166.001 held a dissertation defense for the degree of Doctor of Philosophy.

Currently, as per the Ministry of Education and Science of Ukraine's order dated October 25, 2023 (No. 1309), the Institute has two specialized academic councils:

1. **Council D 26.166.01:** Specializes in 01.02.01 "Theoretical Mechanics" and 01.02.04 "Mechanics of Deformable Solids" (Physical and Mathematical Sciences). The Chairman of the Council is Academician Anatoliy Martyniuk, NASU.

2. **Council D 26.166.02:** Specializes in 01.02.04 "Mechanics of Deformable Solids" (Technical Sciences). The Chairman of the Council is Academician Volodymyr Nazarenko, NASU.

The list of council members is available on the Institute's website [here](#).

No dissertation defenses were held in 2022-2023.

3. Material and technical base of the Institute

3.1. Availability of scientific objects constituting national heritage

There are no scientific objects of national heritage in the Institute.

3.2. Availability of centers for collective use of scientific equipment

In 2010, following the Resolution of the Presidium of the NASU dated April 8, 2009 (No. 95), the Director of the Institute issued an order on February 17, 2010 (No. 4) to establish the Center for Collective Use of Devices, named "Analyzer of Dynamic Processes," within the Department of Dynamics and Stability of Continuum at the Institute of Mechanics.

The Center's equipment includes a portable 8-channel recorder for vibration, acoustic, and strain signals—LMS SCADAS Mobile by LMS International (Belgium), a laptop, and LMS Test.Xpress

software. This setup is utilized for experimental studies of deformation processes in structural elements under shock wave influence.

The Center operates under a standard provision approved by the Presidium of the NASU, which mandates that part of the Center's working time be allocated for providing free services to scientific enterprises of the NASU, as well as universities and other budgetary organizations, based on planned orders.

Dr. V.A. Maksimyuk has been appointed as the Head of the Center. For inquiries related to measurements using the Center's equipment, please contact Dr. Maksimyuk. Oversight of the Center's activities is managed by the Deputy Director of the Institute, Corresponding Member of the NASU M.F. Selivanov.

Additional details can be found on the Institute's website [here](#).

3.3. Compliance of equipment, equipment and staffing with the needs necessary for the implementation of work plans

The scientific departments of the Institute are equipped to meet the basic requirements for executing their work plans. For tasks requiring more advanced computational resources, employees have access to the Department of Mechanics and Computer Engineering. This department not only supports scientific work but also provides computing and communication tools to other departments within the Institute.

Overall, the staffing of the Institute's departments is robust, with high qualifications among the team. Out of the 11 scientific departments, seven are led by academicians or corresponding members of the NASU. Each department's research core includes highly qualified specialists, with at least two Doctors of Sciences and several Candidates of Sciences.

Despite these strengths, there is a pressing need to update the Institute's computer equipment due to its current obsolescence. Additionally, there is a significant demand for the training of young specialists, particularly at the Doctor of Philosophy (Candidate of Sciences) and Doctor of Sciences levels.

4.1 General concept of the Institute's development

From 2017 to 2023, the Institute, in line with the Laws of Ukraine "On Scientific and Scientific-Technical Activities" and "On Higher Education," as well as various resolutions and directives, has conducted fundamental and applied research in applied mathematics. The Institute's research efforts have been guided by its Statute, Development Strategy, and key scientific directions.

The main scientific priorities of the Institute include:

1. Mechanics of composite and inhomogeneous media
2. Mechanics of shell systems
3. Mechanics of coupled fields in materials and structural elements
4. Fracture mechanics and fatigue
5. Dynamics and stability of mechanical systems

Significant new results were achieved in these areas during the reporting period, meeting high international standards and strengthening the Institute's position as a leading Institute in applied mathematics.

The Institute has also focused on training young scientists through postgraduate and doctoral studies. During this period, there were 5 successful defenses of doctoral dissertations, 9 PhD theses, and one dissertation for the degree of Doctor of Philosophy. Of these graduates, 5 Doctors of Sciences, 3 Candidates of Sciences, and one Doctor of Philosophy were employed at the Institute.

In 2018, the Institute developed an educational and scientific program for the training of Doctor of Philosophy in Applied Mathematics and received a license from the Ministry of Education and Science of Ukraine. This license was renewed in 2023, and accreditation of the program is scheduled for 2025.

To attract young talent, the Institute implemented a postdoc training system, adding 3 new researchers through this program. Additionally, nearly two dozen qualified young professionals were hired

for scientific roles through competitive selection. New hires were made across various departments, including Dynamics and Stability of Continuum Media, Rheology, Thermo-Elasticity, Computational Mechanics, Engineering, Thermo-Plasticity, Mechanics of Fracture of Materials, Computational Methods, Structural Mechanics of Thin-Walled Structures, and Stability of Processes.

The Institute's international cooperation has expanded, with specialists trained at the Institute joining leading universities in Austria, Great Britain, France, Germany, Italy, Mexico, and Turkey. These former students maintain close connections with the Institute and contribute to joint research published in both foreign and domestic journals.

A significant portion of recent advancements in continuum mechanics, mechanics of deformable solids, mechanics of structural and composite materials, and oscillation theory can be attributed to the schools established by Academician O.M. Guz. Throughout his tenure as head of the Department of Dynamics and Stability of Continuum Media (1962-2023) and director of the Institute (1976-2022), and now as an adviser to the Institute's Directorate, O.M. Guz has been instrumental in developing internationally renowned schools in mechanics. Many of his students have become prominent figures at leading universities in England, France, Italy, and Mexico, reflecting his profound impact on the field.

Scientific Schools at the Institute

1. Scientific School "Dynamics and Stability of Continuum Media"

Founded by Academician O.M. Guz in 1967, this school has trained 36 doctors and approximately 100 candidates of sciences. Prominent representatives include:

- **Academicians of the NASU:** V.D. Kubenko, V.L. Bogdanov, V.M. Nazarenko
- **Corresponding Members of the NASU:** M.O. Shulga, Y.M. Nemish, I.S. Chernyshenko
- **Academician of the National Academy of Sciences of Azerbaijan:** G.G. Kuliev
- **Corresponding Member of the National Academy of Sciences of Azerbaijan:** S.D. Akbarov
- **Doctors of Physical and Mathematical Sciences:** O.M. Bagno, V.D. Decret, V.V. Zozulya, O.P. Zhuk, P.G. Makhort, among others

Research Directions and Results:

- Development of a three-dimensional linearized theory of stability for deformable bodies, applicable to various models including elastic, elastoplastic, and viscoelastic bodies.
- Theory of propagation and diffraction of elastic waves in coupled bodies.
- Non-destructive methods for determining residual stresses in solids.
- Advances in aerohydroelasticity, non-classical fracture mechanics, rock mechanics, stress concentration in shells, and dynamics of viscous compressible fluids.
- Development of a mathematical model for dynamic interactions of solid particles in a liquid under acoustic waves and studies on wave fields in oil wells during bottom-hole cleaning.

2. Scientific School "Mechanics of Composite Materials"

During the reporting period, this school was led by Academician O.M. Guz and Corresponding Member L.P. Khoroshun. Notable figures include:

- **Doctors of Physical and Mathematical Sciences:** I.Y. Babych, V.F. Meish, E.A. Storozhuk, V.A. Maksymyuk, Y.V. Kokhanenko, V.M. Chekhov, Y.M. Lapusta, D.V. Babich, O.M. Shikula, L.V. Nazarenko, B.P. Maslov, A.S. Shcherbakov.

Research Directions and Results:

- Study of brittle and plastic fracture of composite materials under compression, focusing on stability loss mechanisms.
- Development of theories for predicting effective properties of composite materials and liquid-dispersed mixtures, including two-continuum models for deformation and thermal conductivity.
- Proposal of a new method for layered plates and shells based on a homogeneous stress-strain state.
- Development of a structural theory for coupled deformation and damage processes in composites, incorporating stochastic microporosity and balance equations.

3. Scientific School "Dynamics, Hydroelasticity"

Founded by Academician V.D. Kubenko in 1979, this school has trained 6 doctors and 21 candidates of sciences. Prominent members include:

- **Doctors of Technical Sciences:** A.E. Babaev (member of the National Committee of Ukraine for Theoretical and Applied Mechanics), V.G. Savin
- **Doctors of Physical and Mathematical Sciences:** V.V. Gavrilenko, I.V. Yanchevsky, V.T. Rimsky

Research Directions and Results:

- Development of modern mathematical tools to model complex wave fields in the non-stationary interaction of elastic structures with compressible liquids.
- Creation of a new non-Hertzian theory for impact interactions of solid bodies with liquids or elastic half-spaces.
- Study of high-speed impact interactions with cavities in liquids and the application of multimode approaches to nonlinear oscillations.

Each of these schools has contributed significantly to advancing their respective fields and reinforcing the Institute's position as a leading research Institute in applied mathematics and mechanics.

4. Scientific School "Computational Methods"

Founded by Academician Y.M. Grigorenko in 1970, this school has made significant contributions to computational methods in mechanics. Prominent representatives include:

- **V.D. Budak:** Academician of the Academy of Sciences of Higher Education, Doctor of Technical Sciences, Professor, Rector of Mykolaiv State University
- **Y.G. Savula:** Doctor of Physical and Mathematical Sciences, Professor, Academician of the Academy of Sciences of Higher Education, Dean of the Faculty of Lviv State University
- **A.T. Vasylenko:** Doctor of Physical and Mathematical Sciences, Professor, Laureate of the State Prize of Ukraine in Science and Technology
- **O.Y. Grigorenko:** Corresponding Member of the NASU
- **O.I. Beshpalova:** Doctor of Physical and Mathematical Sciences
- **S.M. Yaremchenko:** Doctor of Physical and Mathematical Sciences

Research Directions and Results:

- Development of approaches to analyze stress-strain states and dynamic characteristics of shell systems using classical, refined, and spatial models.
- Studies on stress states of orthotropic hollow cylinders under asymmetric loads using methods combining variable separation, spline collocation, and discrete orthogonalization.

- Solutions for stress states and oscillations of spatial and thin-walled bodies through numerical-analytical methods.
- Proposals for determining thermoelastic states of shells in various formulations.

5. Scientific School "Stability Theory and Its Applications in Mechanics"

Founded by Academician A.A. Martynyuk in 1978, this school has trained 3 doctors and 28 candidates of sciences. Notable figures include:

- **V.G. Miladzhanov:** Doctor of Physical and Mathematical Sciences
- **N.V. Nikitina:** Doctor of Physical and Mathematical Sciences, Member of the National Committee of Ukraine for Theoretical and Applied Mechanics
- **V.I. Slynko:** Doctor of Physical and Mathematical Sciences, Laureate of the State Prize of Ukraine in Theoretical and Applied Mechanics
- **A.S. Khoroshun:** Doctor of Physical and Mathematical Sciences

Research Directions and Results:

- Development of matrix-valued Lyapunov functions for continuous, discrete, and impulse systems.
- New conditions for system stability in random environments and with imprecise parameters.
- Creation of approaches to study chaotic behavior in system trajectories.
- Establishment of new limits for solutions of nonlinear perturbed motion equations and their applications in synchronization problems.
- Proposals for qualitative analysis of trajectory sets using mixed volumes theory.

6. Scientific School "Mechanics of Coupled Mechanical, Temperature and Electromagnetic Fields in Materials and Structural Elements"

Founded by Professor V.G. Karnaukhov in 1981, this school has trained 8 doctors and 26 candidates of sciences. Prominent representatives include:

- **Y.O. Zhuk:** Member of the National Committee of Ukraine for Theoretical and Applied Mechanics, Laureate of the State Prize of Ukraine
- **I.F. Kyrychok:** Corresponding Member of the NASU
- **I.A. Motovylovets:** Doctor of Technical Sciences
- **I.K. Senchenkov:** Doctor of Physical and Mathematical Sciences
- **V.I. Kozlov:** Doctor of Physical and Mathematical Sciences

Research Directions and Results:

- Development of models and methods for active-passive damping of oscillations using piezoelectric inclusions.
- Study of the effects of dissipation, temperature, and physical nonlinearity on damping efficiency.
- Creation of mathematical models for forced harmonic oscillations and dissipative heating in viscoelastic layered thin-walled elements with piezoelectric actuators, considering geometric nonlinearity and transverse shear deformation.

Collaborative Efforts

The Institute fosters collaboration through:

- Joint scientific seminars and all-institute seminars on mechanics, where both internal and external researchers present and discuss their work.

- Permanent sections of the Academic Council, which facilitate discussions on research results and departmental activities.
- Collaborative research within the Target Program of the Department of Mechanics of the NASU and other research topics under the code KCVK 6541230, involving all departments of the Institute.

These efforts highlight the Institute's commitment to advancing knowledge and fostering collaboration within the scientific community.

5. Results of the Institute's activities

5.1. Research and Development (R&D)

5.1.1. Completed R&D,

In the reporting period from 2017 to 2023, 39 scientific research topics were completed, and a total of 50 research topics were carried out.

No Salary		2017	2018	2019	2020	2021	2022	2023	Just
1	Number of completed research topics, total <i>of which</i> *	5	4	8	6	9	4	3	39
1.1.	There are no analogs in the world or better than existing analogs in the world	2	1	1	3	5	2	3	17
1.2.	there are no analogs in Ukraine	3	1	6	2	4	1	0	17
1.3.	better than existing analogues in Ukraine in all main indicators						1		1
1.4.	exceeds the existing similar developments in Ukraine in terms of certain indicators		2	1	1				4
2.	The number of developments that have been introduced into production and/or practically used at enterprises and Institutes, Institutes, organizations, total <i>including</i>	1	1	2	2	4		2	12
2.1.	in Ukraine	1	1	2	2	4		2	12
2.2.	Abroad								

1. Development of an Integral Method for Analyzing the Stability of Motion of Polynomial Systems and Equations of Perturbed Motion with a Fractional-Like Derivative of the System State Vector

- **Project Number:** 1.3.1.423-20 No DR 0120U103404
- **Supervisor:** Academician of the NASU A.A. Martynyuk

Results:

- Generalization of solutions for individual scientific problems and systematization of approaches.
- **Significant Outcome:** Developed a method using nonlinear integral inequalities for studying polynomial systems. Achieved pseudolinear representation of these inequalities, leading to new limits for the auxiliary Lyapunov function. This method facilitated the study of various types of motion stability, including Lyapunov stability, practical stability, and stability over finite intervals.
- **Additional Contributions:** Introduced new methods for the qualitative analysis of nonlinear systems with fractional-like derivatives and established new limits for solutions of such systems.

Recognition:

- Published scientific articles in both foreign and domestic publications.
- Report presented and published at an international scientific forum.
- Research report approved by the Academic Council of the Institute.

2. Calculation of the Parameters of the Stress-Strain State of Structural Elements of Rocket and Space Technology in the Form of Cylindrical Shells of Complex Geometry and Inhomogeneous Structure under Static and Dynamic Loads

- **Project Number:** 1.3.1.452-23 g.r. No. 0123U100910
- **Leader:** Corresponding Member of the NASU O.Ya. Grigorenko

Results:

- Formulated and substantiated a scientific hypothesis.
- Provided a formulation and method for solving static analysis problems of complex-shaped plates under variable surface loads.
- Proposed a mechanical-mathematical model for oscillations of elastic systems made of conjugate shells with different geometries under combined static axisymmetric loads.
- **Significant Outcome:** Developed a finite element method for free oscillations of inhomogeneous cylindrical shells with complex geometries. Established stages and forms of result control, solved a test problem, and presented a method for finite element selection for dynamics of thin and thick shells. Addressed non-axisymmetric oscillations of asymmetric three-layer cylindrical elements with discrete-symmetric, rib-reinforced aggregates under non-stationary loads.

Recognition:

- Published scientific articles in both foreign and domestic publications.
- Report presented and published at an international scientific forum.
- Research report approved by the Academic Council of the Institute.

3. Stability and Overcritical Behavior of Fibrous and Layered Composite Materials and Structural Elements with Local Defects and Imperfections under Different Load Conditions

- **Project Number:** R&D 1.3.1.400 – 16, Reg. No. 0115U005702

- **Customer:** NASU
- **Implementation Period:** 2016-2019
- **Scientific Adviser:** Corresponding Member of the NASU, Doctor of Technical Sciences V.M. Nazarenko

Results:

- Formation of a new research direction focusing on models and numerical algorithms for analyzing attenuation of edge effects and critical stability parameters of composites in subcritical states.
- **Significant Outcomes:**
 - Revealed new properties related to the influence of geometric imperfections on the stability and behavior of composite cylindrical shells under compressive loads.
 - Investigated local bends (convex and concave) and their impact on the stability of shell elements, showing that considering these imperfections enhances the accuracy of shell element strength assessments.
- **Practical Impact:** Improved calculation methods for composite structural elements in mechanical engineering, shipbuilding, and aircraft construction, leading to increased economic and technological efficiency.

Recognition:

- 1 collective monograph published in a foreign edition.
- 2 chapters in a collective monograph in a domestic publication.
- 13 scientific articles in domestic professional journals and 7 in foreign journals.
- 27 abstracts of reports presented at international scientific conferences.
- Research report approved by the Academic Council of the S.P. Timoshenko Institute of Mechanics of the NASU on December 24, 2019, Minutes No. 7.

4. Numerical Modeling of Stability and Fracture Problems of Composites Using High-Performance Calculations

- **Project Number:** SRW 1.3.1.440–21 No a.d. 0120U101775
- **Customer:** NASU
- **Implementation Period:** 2021-2022
- **Supervisor:** Doctor of Physical and Mathematical Sciences V.A. Decree

Results:

- Development of methods for stability and fracture problems of composites requiring extensive computational resources.
- **Significant Outcomes:**
 - Created a distributed computing environment using the supercomputer SCIT of the Institute of Cybernetics and the server of the Institute of Mechanics for numerical solutions.
 - Studied new mechanisms of destruction in reinforced composite materials related to structural instability and interfacial defects.
- **Practical Impact:** Enhanced computational algorithms and technologies for better and more accurate results in composite destruction mechanisms. This approach also reduces the need for extensive experimental research, leading to cost savings and improved design methods for composite structural elements in various industries.

Recognition:

- 4 scientific articles published in domestic professional journals and 2 in foreign journals indexed by Scopus.
- Research report approved by the Academic Council of the Institute of Mechanics S.P. Timoshenko of the NASU on December 26, 2022, Protocol No. 10.

5. Numerical Modeling of Dynamics and Statics of Layered Shell Elements of Complex Geometry in Relation to Atomic and Space Industries

- **Project Code:** 417-20
- **Customer:** NASU
- **Implementation Period:** 2020-2024
- **Supervisor:** Doctor of Technical Sciences, Prof. P.Z. Lugovoi

Results:

- Developed a method for solving dynamic problems of composite shell structures, including oscillation equations with boundary and initial conditions.
- Constructive-orthotropic model of a three-layer shell structure with a cellular filler used.
- **Significant Outcomes:**
 - Created a method for modeling dynamics of asymmetrical three-layer composite structures, including cylindrical shells with spherical domes under distributed and local loads.
 - Studied oscillations and natural frequencies of multilayer cylindrical shells with various reinforcements and attached masses.
 - Proposed a new method for qualitative and quantitative analysis of nonlinear mechanical vibrations in shell structures.

Recognition:

- Published scientific articles in a domestic publication.
- Annual reports approved at the section "Mechanics of Shell Systems."
- Practical application: Provided theoretical developments for Yuzhnoye SDO, determining resonance frequency ranges for shell elements in launch vehicles, which is crucial for preventing accidents.

6. Construction of Approximate Solutions of Nonlinear Problems of Propagation of Harmonic and Single Waves in Elastic Materials

- **Project Code:** 418-20
- **Customer:** NASU
- **Implementation Period:** 2020-2023
- **Supervisor:** Corresponding Member of the NASU J.J. Rushchitsky

Results:

- Investigated single waves in materials undergoing elastic and nonlinear deformation.
- Focused on wave profile evolution using the five-constant Murnaghan model.
- **Significant Outcomes:**
 - Theoretical and numerical analysis of nonlinear longitudinal and transverse waves with various initial profiles.
 - Developed insights into the effect of nonlinearity and initial wave parameters on wave evolution.

- Published findings contribute to modern nonlinear wave theory.

Recognition:

- Published in leading international journals and books on nonlinear waves.
- Prepared a doctoral dissertation in this area.
- Published 1 monograph, chapters in monographs, 10 articles, and 30 abstracts at international conferences.
- Research report approved at a meeting of the Academic Council of the Institute, December 29, 2020, Minutes No. 12.

Consequences:

- Theoretical and practical importance for designing critical structural elements in rocket, aviation, and shipbuilding to enhance performance and reliability.

7. Development of Methods for Determining the Creep and Relaxation Characteristics of Isotropic Nonlinear Viscoelastic Materials Under Complex Stress State

- **Project Code:** 1.3.1.407-16 (g.r. No 0115U005707)
- **Supervisor:** Dr. V.P. Golub

Results:

- Proposed and experimentally substantiated a single deformation diagram for nonlinear viscoelastic materials, invariant with respect to stress state type and time.
- Developed methods for determining creep and relaxation characteristics of isotropic nonlinear viscoelastic materials under complex stress conditions.
- Established methods for identifying the nuclei of heredity and their relationship under various stress states.
- **Significant Outcomes:**
 - Provided recommendations for determining parameters of heredity nuclei based on the proportionality hypothesis of guide tensors and nonlinear dependencies between strain and stress tensors.

Recognition:

- 7 scientific articles published in foreign journals.
- 18 articles published in domestic journals.
- Obtained a patent for an invention.

Consequences:

- Implementation potential for improving the understanding and application of nonlinear viscoelastic materials in various engineering contexts.
- Research report approved at a meeting of the Academic Council, December 26, 2017, Minutes No. 5.

8. Forced Resonance Oscillations and Dissipative Heating of Flexible Inelastic Plates and Shells with Piezoelectric Sensors and Actuators Taking into Account Shear Deformations

- **Project Code:** 1.3.1.403-16

- **Scientific Adviser:** Doctor of Physical and Mathematical Sciences, Prof. V.G. Karnaukhov

Results:

- Developed refined mathematical models and numerical methods for studying the thermoelectromechanical behavior and thermal destruction of flexible inelastic plates and shells under harmonic electromechanical load.
- Addressed forced resonant oscillations and dissipative heating of thin-walled structural elements with piezoelectric sensors and actuators.
- **Significant Outcomes:**
 - Revealed new effects due to the coupling of electromechanical and temperature fields, including the impact of transverse shear deformations and geometric nonlinearity.
 - Provided recommendations for damping resonant oscillations using piezoelectric sensors and actuators and improving their performance.

Recognition:

- Results included in publications in professional scientific journals.
- Recommendations on damping and performance improvement presented at international scientific conferences.
- Practical implications for enhancing the performance of inelastic thin-walled structural elements.

9. Dynamics of Systems of Liquid-Filled Semi-Confined Elements of the Design of Missile Movement Control Systems in the Atmosphere

- **Project Code:** 1.3.1.415-19
- **Scientific Adviser:** V.D. Kubenko

Results:

- Developed a theory of acoustic interaction of spherical bodies with compressible fluid in semi-bounded cavities.
- Created methods for solving boundary problems for multi-connected systems of spherical bodies in semi-bounded cylindrical cavities with liquid.
- Formulated theories of regular and singular control of dynamical systems using hydrodynamic analogy and improved methods for calculating trajectories with singular arcs in optimally controlled dynamic systems.
- Addressed contact problems of electroelasticity with imperfections in the contact zone.

Recognition:

- Research report approved at a meeting of the Academic Council of the Institute of Mechanics, S.P. Timoshenko of the NASU.
- Published in professional scientific domestic and foreign journals.
- Presented at international scientific conferences with positive feedback from the customer's representative.

Consequences:

- Results applicable to Institutes in the oil and aerospace industries, enhancing the analysis and design of control systems for missile movement and other applications.

5.2. Publication Activity of the Institute's Researchers

5.2.1. Number of Publications Prepared by the Institute's Researchers For 7 Years (*units*)

Type of publications	2017	2018	2019	2020	2021	2022	2023	Total	
								Units	in %
The total number, <i>including</i> :	356	400	263	284	281	180	362	2126	100
Articles in scientific periodicals indexed by leading scientometric databases (Web of Science, Scopus)	79	98	77	74	82	88	72	570	26,81
Articles in domestic scientific journals included in the List of scientific professional publications of Ukraine	136	160	126	110	95	40	85	752	35,37
Articles in scientific periodicals indexed by other international databases	119	125	95	88	73	40	76	616	28,97
Monographs (total) <i>including</i> :	7	4	6	9	9	3	20	58	2,82
Sole proprietors	3	1	1	1	2	0	1	9	1,51
Chapters in collective Books			2	2	3	2	16	25	1,32
Scientific and educational literature (textbooks, manuals)			1	2	6		15	24	0,19
Articles in non-periodical collections of scientific papers	17	35	31	22	22		9	136	6,40
Articles in foreign periodicals	75	97	74	69	75	85	52	527	24,79
Articles, interviews, etc., in popular science media, including electronic		1	3	2	5	0	4	15	0,71
Abstracts of international conferences held abroad	9	8	7	8	7	7	4	50	2,35
Abstracts of international conferences held in Ukraine and published in peer-reviewed collections of materials of domestic conferences	125	131	148	70	81	38	164	757	35,61
Scientific reports on the topic of research (with the recommendations of the Academic Council for publication in electronic or printed form)	?								

Scientific Publications of Sources and Monuments of Science and Culture with Scientific Novelty									
Scientific reference publications (encyclopedias, reference books, scientific catalogs, reviews)									
Scientific publications published on professional moderated Internet resources	4	1	3	5	7	3	20	43	
Reviews, expert opinions, published in scientific periodicals									
Other publications (popular science, methodology, preprints, etc.)		2		4	5	6	15	32	0,94
Number of publications per 1 researcher								**** *	X
Total Number	3,46	3,77	2,48	2,70	2,68	1,64	3,12	19,81	X
articles in domestic scientific journals included in the List of scientific professional publications of Ukraine	1,32	1,51	1,19	1,05	0,90	0,36	0,73	7,01	X
Articles indexed in leading databases (Web of Science, Scopus) ****	0,77	0,92	0,73	0,70	0,78	0,80	0,62	5,31	X
other publications*****	1,37	1,34	0,57	0,95	0,99	0,47	1,77	7,49	X
The total number, including:	215+7 +134	258+ 4+13 8	203+ 4+1+ 55	187+ 7+2+ 88	180+ 6+7+ 88	131+ 4+45	157+2 2+15+ 168		100
Number of researchers	103	106	106	105	105	110	116	107,3	

Publications and Speeches in the Media

Types of posts	2017	2018	2019	2020_	2021	2022	2023	Just
Articles about individual scientists and the institute, including interviews	1	3	1	1	-	1	3	10
Analytical, journalistic, educational and other articles of the Institute's scientists, including interviews	1	1	2	1	6	1	1	13
Articles on electronic resources (except for popular science)	1	1	5	3	4		2	16
Analytical, journalistic, educational and other							1	1

Types of posts	2017	2018	2019	2020_	2021	2022	2023	Just
appearances on radio, television and online media								

5.2.2. List of the most important publications of the Institute's researchers (10-15 units)

Salary No.	Name	Publisher, journal (title, issue, year, pages), URL or link to the site where the publication is posted	Authors' names	Number of quotes	Impact Factor*
1	Fracture of Materials Under Compression Along Cracks	Book Springer Nature Switzerland AG 2020 https://doi.org/10.1007/978-3-030-51814-1	Guz A.N., Bogdanov V.L., Nazarenko V.M.	10	
2	Stability of a Sandwich Cylindrical Shell with Core Subject to External Pressure and Pressure in the Inner Cylinder	Int. Appl. Mech.– 2020. – 56, №1 – P. 40-53. https://doi.org/10.1007/s10778-020-00995-y	Semenyuk N.P., Zhukova N.B.	8	0.6
3	Selected Problems in the Elastodynamics of Piezoceramic Bodies	Advanced Structured Materials, Vol. 154, Cham: Springer Nature Switzerland AG, 2021. – 227 p. https://doi.org/10.1007/978-3-030-74199-0	Grigorenko O.Y., Müller W. H., Loza I. A.	11	
4	Numerical Analysis of Free Vibrations of Piezoelectric Cylinders	New Achievements in Continuum Mechanics and Thermodynamics, Chapter 14, «Springer», Switzerland, 2019. – P. 187 – 196. https://doi.org/10.1007/978-3-030-13307-8_14	Grigorenko O.Y., Loza I.A., Yaremchenko S.M.	8	
5	Almost periodic dynamics a new class of impulsive reaction-diffusion neural networks with fractional-like derivatives	Chaos, Solitons and Fractals. – 2021. – 143, 8 pages, https://doi.org/10.1016/j.chaos.2020.110647	Stamov G., Stamova I., Martynyuk A., Stamov T.	20	9.922
6	Stability of abstract linear switched impulsive differential equations	Automatica J. IFAC. – 2019.– 107. – P. 433 – 441. https://www.sciencedirect.com/science/article/abs/pii/S0005109819302948	Slynko V.I., Tunc C.	37	5.541
7	Advanced in Mechanics: Current Research Results of the NAS of Ukraine.	Advanced Structured Materials, vol.191. – Cham, Springer, 2023. – 560 p. – ISBN 978-3-031-37312-1.	Guz A.N., Altenbach H., Bogdanov V.L., Nazarenko V.M.	2	

8	Dynamic Design of Compound Shell Structures of Revolution Under Nonstationary Loads	Int. Appl. Mech. – 2020, 56, no. 1 – P. 22–32. doi.org/10.1007/s10778-020-00993-0	Lugovoi P.Z., Meish V.F., Meish Y.A., Orlenko S.P.	21	0.6
9	Analysis of creep strains and stress relaxation in thin-walled tubular members made of linear viscoelastic materials. 1. Superposition of shear and volume creep	Int. Appl. Mech, 2020, 56, №2 – P. 156-169. https://doi.org/10.1007/s10778-020-01011-z	Golub V.P., Pavlyuk Y.V., Reznik V.S	6	0.6
10	“Resonance” phenomenon of kinematic excitation by a spherical body in a semi-infinite cylindrical vessel filled with liquid	Springer, Acta Mechanica. – v. 230, No. 3. – 2019. – pp. 1009 – 1025. DOI 10.1007/s00707-018-2310-4. https://link.springer.com/article/10.1007/s00707-018-2310-4	Kubenko V.D., Yanchevsky I.V.	7	2.15
11	A semi-analytical solution method for problems of cohesive fracture and some of its applications	Springer Nature, International Journal of Fracture, 212, 2018, pp. 113–121, https://doi.org/10.1007/s10704-018-0295-6	Selivanov M. F., Chornoivan Y.O.	14	2.7
12	An analytical method of modeling the process zone near the tip of an interface crack due to its kinking from the interface of quasi-elastic materials.	Elsevier, International Journal of Solids and Structures. 2023. - 267. - 112117 https://doi.org/10.1016/j.ijsolstr.2023.112117	Kaminsky A.O., Dudyk M., Reshitnyk Y., Chornoivan Y.O.	4	3.6
13	Thermomechanics of inelastic thin-walled structural members with piezoelectric sensors and actuators under harmonic loading	Springer, International Applied Mechanics. – 2017. – Vol. 53, Issue 1. – P. 6–58. – DOI: https://doi.org/10.1007/s10778-017-0789-3	Karnauchov V.G., Kirichok I.F., Kozlov V.I.	25	0.6
14	Foundations of Mechanics of Materials	Copenhagen: Ventus Publishing ApS, 2021 - 276 p. ISBN 978-87-403-3706-8	Rushchitsky J.J.	1	
15	Elastic and Inelastic Stress Waves - letter E	Encyclopedia of Continuum Mechanics. Eds. H. Altenbach, K. Oster. Berlin, Springer, 2018–2020, –P.100–118. ISBN, 3662557703, 9783662557709	Rushchitsky J.J.		

5.2.3. Information on Scientific Publications, the Founder (Co-Founder) of Which Is The Institute

The scientific journal "Applied Mechanics" (ISSN 0032-8243) was founded in March 1955 (since 2021 it has been published in Ukrainian). Since 1965 he has been regularly translated into English under the title "Soviet Applied Mechanics" (ISSN 1063-7095), and since 1992 under the title "International Applied Mechanics" (since 2004 by Springer Publishing).

The name of the journal according to the certificate of registration (see below for a copy of the Certificate)	International Scientific Journal "Applied Mechanics"
Publisher (name of Institute, contact information)	S.P. Timoshenko Institute of Mechanics of the NASU, Nesterova St., 3, 03057, Kyiv, Ukraine Tel.: +380(44)-596-77-56 Fax: +380(44)-596-77-28; e-mail: inst_mech@inmech.kyiv.ua
Founders	NASU, S.P. Timoshenko Institute of Mechanics of the NASU
Name of the magazine in English (or in Latin) according to the ISSN	Applied Mechanics is published by the Springer Group under the title " <u>INTERNATIONAL Applied Mechanics</u> " Journal Impact Factor 0.7 (2023) 5-year Journal Impact Factor 0.6 (2017-2023) H-Index 37 Mechanical Engineering Q4
Abbreviated name of the journal	Traditionally, since the beginning of the journal's publication in 1955, reference has been made to the journal "Prikl. mechanics" or "Int. Appl. Mech."
When was the publication founded?	The journal was founded in March 1955. Certificate of registration KB No. 480 dated March 3, 1994.
Average monthly volume	144 pages.
Type of review	Blind peer review by a single reviewer
Thematic focus	The journal provides up-to-date coverage of research in solid mechanics, general mechanics and mechanics of structural elements (shells and plates) with reference to the stress-strain state, stability, dynamics and wave propagation. Areas of interest include composite mechanics, residual stress mechanics, mechanics of structures interacting with liquids and gases, and more. Articles published in the journal also deal with motion stability, nonlinear dynamics, and solid-state mechanics. The journal examines the practical problems commonly faced by mechanical engineers working in the aerospace, shipbuilding, turbomachinery, and construction industries.
Languages of publication	English, Ukrainian

Category in the list of scientific professional publications of Ukraine	And
<p>Indexing in international scientometric databases</p> <p>Link to the publication's web resource http://pm.inmech.kiev.ua/</p>	<p>SCOPUS, Google Scholar, Web of Science, Academic Search Alumni Edition, Academic Search Complete, Academic Search Premier, Advanced Polymer Abstracts, Aerospace and High Technology Database, Aluminum Industry Abstracts, Ceramic Abstracts – World Ceramic Abstracts, Compendex, Computer and Information Systems Abstracts, Copper Data Center Database, Corrosion Abstracts, CSA Engineering Research Database, CSA High Technology Research Database with Aerospace, CSA Materials Research Database with METADEX, CSA Technology Research Database, CSA/ASCE Civil Engineering Abstracts, Current Abstracts, Current Contents/Engineering, Computing and Technology, Digital Mathematics Registry, Earthquake Engineering Abstracts, Electronics and Communications Abstracts, Engineering Materials Abstracts, Ceramics, Engineering Index Monthly, INIS Atomindex, Inspec, Journal Citation Reports/Social Sciences Edition, Materials Business File-Steels Alerts, Materials Science Citation Index, Mathematical Reviews, MathSciNet, Mechanical and Transportation Engineering Abstracts, METADEX (Metals Abstracts), OCLC ArticleFirst Database, OCLC FirstSearch Electronic Collections Online, Science & Technology Collection, Science Citation Index Expanded (SciSearch), Solid State and Superconductivity Abstracts, Summon by Solutions, TOC Premier, Zentralblatt Math.</p> <p>Year International Collaboration</p> <p>2017 1.52 2020 1.52 2023 6.12</p> <p>2018 2.78 2021 1.49</p> <p>2019 5.00 2022 4.48</p>

5.2.4. List of Scientific Publications in Which the Institute's Researchers Were Published Most Often During the Reporting Period (*no more than ten*)

Name of the publication, founders, year of publication, publication website	Scientometric database, which includes the publication, category of the publication according to the List of scientific professional publications of Ukraine	Number of published articles
International Scientific Journal "Applied Mechanics"* http://pm.inmech.kiev.ua/	According to the List, the NFV of Ukraine has category A	237
International Applied Mechanics* ISSN 1063-7095	Scopus, Web of Science, etc.	47
Reports of the NASU ISSN:1025-6415 (Tel. 2518-153X)	According to the List, the NFV of Ukraine has category B	34
Bulletin of Taras Shevchenko National University of Kyiv. Mathematics. Mechanics ISSN: 1684-1565	According to the List, the NFV of Ukraine has category B	16
A series of books in the publishing house Springer Ec. view. ISSN 1869-8441 Print. ISSN 1869-8433	Scopus, Web of Science	13
Bulletin of Zaporizhzhya National University: Phys.-Math. Science. The new name is <u>Computer Science and Applied Mathematics</u> ISSN: 2786-6254 (el. 2518-153X)	According to the List, the NFV of Ukraine has category B	10
Journal of Mathematical Sciences ISSN: 1072-3374 (el. ed. 1573-8795)	Scopus, Web of Science	9
Mathematical methods and physico-mechanical fields ISSN: 1072-3374 (el. ed. 1573-8795)	Scopus, Web of Science	9
Archive of Applied Mechanics ISSN: 0939-1533 (el. 1432-0681)	Scopus, Web of Science	5
Bulletin of the National Transport University. Technical Sciences. ISSN 2308-6645 (el. 2523-496X)	According to the List, the NFV of Ukraine has category B	237

5.2.5. Problem-Oriented Databases

During the reporting period, there was no need to create problem-oriented databases. Also, they were not ordered by third-party organizations.

5.3. Additional Results of Activities

5.3.1. Provision of Scientific Services and Solution of Infrastructure Problems

Research and Collaborative Projects

The Institute has provided various scientific services, including conducting research commissioned by third-party organizations. Notable collaborations include:

- **Yuzhnoye SDO M.K. Yangel**
- **Central Research Institute of Armament and Military Equipment of the Armed Forces of Ukraine**
- **Kyiv National Medical University O.O. Bogomolets**
- **Joint Stock Company "Ivano-Frankivsk Locomotive Repair Plant"**
- **Ukrainian Research Institute of Special Equipment and Forensic Expertise of the Security Service of Ukraine**

The Institute has also been involved in training specialists at various levels, from masters to doctors of sciences, for educational and industrial organizations in Ukraine. This training is reflected in the detailed questionnaires of the Institute's departments.

Center for Collective Use of Devices "Analyzer of Dynamic Processes"

Collaborations:

- **National Center of Folk Culture "Ivan Honchar Museum"**

Projects and Findings:

1. **2017 Research for Ivan Honchar Museum:**
 - **Objective:** Determine acoustic properties, including vibration spectra, and time characteristics of musical instrument performance.
 - **Tools Used:** LMS SCADAS Mobile recorder, GDS-806S oscilloscope.
 - **Results:** Experimental investigation of time and amplitude characteristics of percussion instruments. New amplitude-temporal regularities in rhythms of Ukrainian dance folk music were revealed, contributing to humanitarian and art historical knowledge.
2. **2020 Upgrades and Research:**
 - **Objective:** Measure dynamic characteristics of musical performances with a focus on long-term compositions.
 - **Upgrades:** New computer with Intel Core i7 processor.
 - **Tools Used:** LMS SCADAS Mobile recorder, WIKA A-10 dynamic pressure sensor.
 - **Results:** Investigation of dynamic characteristics of accordion performances.

The results of the research became the basis of scientific publications:

1. Anikiev I.I., Maksymyuk V.A., Sushchenko E.O., Fetisov I.B. On Measuring the Temporal Characteristics of Performing Musical Works on Drums with the Help of the LMS SCADAS Mobile Analyzer. Sci.-Tech. Conf. "Physical Processes and Fields of Technical and Biological Objects", November 3 – 5, 2017, Kremenchuk.–Publishing: KrNU, 2017.–P. 7–9.
2. Anikiev I.I., Maksymyuk V.A., Sushchenko E.O., Fetisov I.B. On measurement of dynamic pressure in the percussion pipe and musical instruments with the WIKA A-10 sensor. Mechanics 2021.– 57, No5. – P. 87 – 98.
3. Anik'ev I.I., Maksymyuk V.A., Sushchenko E.A., Fetisov I.B. Measuring Dynamic Pressure in Shock Tube and Musical Instruments with WIKA A-10 Sensor // Int. Appl. Mech. – 2021. – 57, N 5. – P. 568 – 577.

5.3.2. Expert activity

Expert Roles and Assessments

- **S.M. Yaremchenko**

- **Position:** Leading Researcher, Doctor of Physical and Mathematical Sciences
- **Role:** Expert of the section of the Expert Council of the Ministry of Education and Science in the professional field "Mechanics" since 2022.
- **A.S. Khoroshun**
 - **Position:** Leading Researcher, Doctor of Physical and Mathematical Sciences
 - **Role:** Conducted expert assessment of requests for scientific (scientific and technical) work in the direction of "Support of priority scientific research and scientific and technical (experimental) developments" of the budget program KCVK 6541230.
- **I.L. Ivanov**
 - **Position:** Senior Researcher, Ph.D.
 - **Role:** Carried out scientific and expert publications as part of the Working Group on Mathematical Modeling of Problems Related to the SARS-CoV-2 Coronavirus Epidemic in Ukraine, in collaboration with the Institute for Problems of Mathematical Machines and Systems of the NASU.
- **V.I. Kozlov**
 - **Position:** Leading Researcher, Doctor of Physical and Mathematical Sciences
 - **Role:** Made an expert assessment of a scientific work request for the competition in the priority area "Mechanics and technologies of rocket and space, aviation and power systems, mechanics of materials and structures for 2023-2024."
- **Y.O. Zhuk**
 - **Position:** Leading Researcher, Corresponding Member of the NASU
 - **Roles:**
 - Member of the Expert Council on Physical and Mathematical Sciences of the Department of Personnel Certification of the Ministry of Education and Science of Ukraine since 2023.
 - Expert of the Scientific and Technical Council on Mechanics at the Ministry of Education and Science of Ukraine (2019-2023).
 - Scientific expert at the State Fund for Fundamental Research of Ukraine (2018-2019).
- **V.M. Nazarenko**
 - **Position:** Academician of the NASU, Acting Director of the Institute
 - **Role:** Reviewed a request for funding scientific research on "Deformation, dynamics, and stability of structural-anisotropic shells made of functional-gradient materials under thermo-force action" for the National University of Water and Environmental Engineering in 2023.
- **National Committee of Ukraine for Theoretical and Applied Mechanics**
 - **Role:** Conducted expert activities ordered by this committee.

Dissertation Opponents

- **V.G. Karnaukhov**
 - **Dissertations Opposed:** 5 for Doctor of Sciences, 1 for Doctor of Philosophy.
- **Y.O. Zhuk**
 - **Dissertations Opposed:** 6 for Doctor of Sciences, 6 for Candidate of Sciences (Doctor of Philosophy).
- **I.K. Senchenkov**
 - **Dissertations Opposed:** 3 for Candidate of Sciences (Doctor of Philosophy).
- **P.Z. Lugovoi**
 - **Dissertations Opposed:** 1 for Doctor of Sciences, 1 for Doctor of Philosophy.
- **O.Y. Grigorenko**
 - **Dissertations Opposed:** 2 for Doctor of Sciences, 1 for Candidate of Sciences.
- **B.P. Maslov**
 - **Dissertations Opposed:** 1 for Doctor of Sciences.
- **V.P. Golub**

- **Dissertations Opposed:** 3 for Candidate of Sciences.
- **V.I. Slynko and A.S. Khoroshun**
 - **Dissertations Opposed:** For the degree of Doctor of Philosophy at the Institute of Mathematics of the NASU.

Peer Reviews of Scientific Work

- **Reviewing Journals:**
 - **Latin American Journal of Solids and Structures**
 - **International Applied Mechanics**
 - **Continuum Mechanics and Thermodynamics**
 - **Mathematics and Mechanics of Solids**
- **Peer Reviews for Journals and Monographs:**
 - **Applied Mechanics**
 - **Welding and Related Processes and Technologies**
 - **Automatic Welding**
 - **Reports of the NASU**
 - **Mathematical Methods and Physical and Mechanical Fields**
 - **Bulletin of Taras Shevchenko National University of Kyiv, Mathematics. Mechanics**
 - **Advanced Structured Materials book series, Springer**

These activities reflect the Institute's active involvement in advancing scientific knowledge and maintaining high standards in academic and practical applications of mechanics and related fields.

5.3.3. Additional indicators characterizing the features of the activities and uniqueness of the Institute.

Research Focus

The Institute's scientific activity primarily involves:

- **Fundamental Research:** Exploring new fundamental knowledge in various fields of applied mathematics, including:
 - Continuum Mechanics
 - Theoretical Mechanics
 - Mechanics of Deformable Solids
 - Mechanics of Fluids and Gases
 - Mechanics of Structural and Composite Materials
 - Mechanics of Interaction of Bodies with Media and Various Physical and Mechanical Fields
 - Oscillation Theory
- **Applied Research:** Translating scientific and technical knowledge into practical applications.
- **Education and Training:** Training highly qualified scientific personnel.
- **Innovation and Development:** Contributing to the country's innovative development and addressing social, economic, and cultural needs.

Publication of Monographs

The Institute's fundamental research findings are documented in numerous monographs. Key publications include:

- **O.M. Guz:**
 - *Eight Non-Classical Problems of Fracture Mechanics* in: *Advanced Structured Materials*, Vol. 159. Cham: Springer Nature Switzerland AG, 2021.
 - ISBN: 978-3-030-77500-1 (Hardcover), 978-3-030-77503-2 (Softcover), 978-3-030-77501-8 (eBook)
- **O.M. Guz, V.L. Bogdanov, V.M. Nazarenko:**
 - *Fracture of Materials Under Compression Along Cracks* in: *Advanced Structured Materials*, Vol. 138. Cham: Springer Nature Switzerland AG, 2020.
 - ISBN: 978-3-030-51814-1
- **A.A. Martynyuk, B. Radziszewski, A. Szadkowski:**
 - *Stability: Elements of the Theory and Applications with Examples*. Warsaw: Sciendo, 2020.
 - ISBN: 978-83-66675-27-8, DOI: 10.2478/9788366675285-fm
 - Co-authors: Institute of Mechanics S.P. Timoshenko NAS of Ukraine, Institute of Fundamental Technological Research of Polish Academy of Sciences and Kielce University of Technology, Poland, and Meritor Automotive, Inc., USA

Journal Publication

- **Journal:** *Applied Mechanics* (founded in 1955, regularly translated into English as *International Applied Mechanics* by Springer Publishing House since 1965)
 - **Role:** An important platform for disseminating the Institute’s achievements to both Ukrainian and international scientific communities.

The Institute’s commitment to fundamental research, practical application, education, and innovation underscores its pivotal role in advancing scientific knowledge and technology.

5.4. Objects of Intellectual Property Rights

5.4.1. Results of Creation and Use of Objects of Intellectual Property Rights (*units*).

Objects of intellectual property rights		2017	2018	2019	2020	2021	2022	2023
Patents for Inventions and Utility Models, Industrial Designs, Plant Varieties	Received	2	1		3			
	Put on the balance sheet							
Other objects of intellectual property rights	Received							
	Put on the balance sheet							
Rights of Use/ License	Provided							
	Received and put on the balance sheet							

5.4.2. List (up to 10) of Received Documents for Objects of Intellectual Property Rights

1. **Utility Model Patent (2017):** *Method for Determining the Mechanical Properties of a Material under a Complex Stress State*, No. 121469.

2. **Utility Model Patent** (2017): *Modified Reload Device*, No. 113294.
3. **Utility Model Patent** (2018): *Method for Determining the Yield Strength of a Material*, No. 128646.
4. **Utility Model Patent** (2020): *Test Method for Tubular Specimens of Semibrittle Materials*, No. 140072.
5. **Utility Model Patent** (2020): *Screw Implant*, No. 145678.
6. **Patent** (2020): Golub V.P., Pelykh V.M., Pogrebnyak A.D. *Method for Determining the Physical Limit of Fatigue of a Material under Conditions of Uniaxial Asymmetric Load*.
 - Description: Specialized database "Inventions (utility models) in Ukraine".
 - Patent Number: UA (11)140174 (13)U
 - IPC Code: G01N3/00
7. **Utility Model Patent** (2024): *Method for Determining the Yield State in Uniaxial Tension and Compression* (Application filed in 2023).
8. **Utility Model Patent** (2024): *Stand for Determining the Strength of Resistance to the Movement of a Bullet in a Liquid into Which It Flies at a Given Angle* (Application filed in 2023).
9. **Utility Model Patent** (2024): *Orthopedic Construction with Increasing Rigidity* (Application filed in 2023).
10. **Utility Model Patent** (2024): *Method of Power Supply of an Electric Rocket Engine on Heliocentric Arcs of Interplanetary Transitions* (Application filed in 2023).

6. Scientific Events and Public Relations

6.1. List of Major Conferences, Other Scientific and Public Events Held by The Institute for 7 Years

International Scientific Conference "Actual Problems of Mechanics – 2023"

Dates: November 14-16, 2023

Format: Mixed (offline and online)

Locations: Kyiv, Dnipro, Lviv, Kharkiv

Organizers: Institute of Mechanics S.P. Timoshenko of the NASU, National Committee of Ukraine for Theoretical and Applied Mechanics

Purpose: The conference was dedicated to the 145th anniversary of the birth of Academician Stepan Prokopovych Timoshenko (1878–1972), a world-renowned Ukrainian mechanical scientist and engineer, who was a key figure in the founding of the Ukrainian Academy of Sciences (now NASU) and the first director of the Institute of Mechanics.

Key Highlights:

- **Plenary Session:**
 - **Professor Holm Altenbach**, Institute of Mechanics, University of Magdeburg (Germany), and foreign member of NASU, gave a report on Academician S.P. Timoshenko. His presentation highlighted Timoshenko's contributions to modern engineering education.
- **Participants:**
 - The conference was attended by mechanical scientists from Austria, Azerbaijan, Brazil, Germany, Spain, and Turkey, demonstrating the international recognition of Academician Timoshenko's impact.

Significance:

- The event celebrated the legacy of Academician Timoshenko, underscoring his role in shaping contemporary engineering education and fostering international scientific collaboration in the field of mechanics.

Date	Name and type of event	Venue (city, co-organizer)
May 25 – 28, 2017	VI International Scientific and Technical Conference "Actual Problems of Applied Mechanics and Structural Strength"	Zaporizhzhia, Zaporizhzhya National Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
17 - 20 April 2017	International Conference "Mathematical Problems of Technical Mechanics – 2017"	Kamianske, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
16 - 19 April 2018	XVIII International Conference "Mathematical Problems of Technical Mechanics – 2018"	Kamianske, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
15 - 18 April 2019	International Conference "Mathematical Problems of Technical Mechanics and Applied Mathematics – 2019"	Kamianske, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
23 – 26 May 2019	VII International Scientific and Technical Conference "Actual Problems of Applied Mechanics and Structural Strength"	Zaporizhzhia, Zaporizhzhya National Technical University. Co-organizer S.P. Timoshenko Institute of Mechanics of the NASU
02 - 05 December 2019	International Conference "Mathematical Problems of Technical Mechanics and Applied Mathematics – 2019" Part 2	Dnipro, Kamianske, Dnipro State Technical University. Co-organizer S.P. Timoshenko Institute of Mechanics of the NASU
13 - 16 April 2020	XX International Scientific Conference "Mathematical Problems of Technical Mechanics and Applied Mathematics – 2020"	Dnipro, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
11 – 14 June 2020	VIII International Scientific and Technical Conference "Actual Problems of Applied Mechanics and Structural Strength"	Zaporizhzhia, Zaporizhzhya National Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
07 -10 December 2020	International Scientific Conference "Innovative Technologies, Cybersecurity Management Models ITMK-2020"	Dnipro, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
13 - 16 April 2021	XXI International Scientific Conference "Mathematical Problems of Technical Mechanics – 2021"	Dnipro, Kamianske, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
April 11-14, 2022, part 1 December 12- 14, 2022, part 2	International Scientific Conference "Innovative technologies, cybersecurity management models ITMK-2022"	Dnipro, Dnipro State Technical University. Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU
April 2023, part 1, October 2023, Section 2	XXIII International Scientific Conference "Mathematical Problems of Technical Mechanics – 2023"	Dnipro, Oles Honchar Dnipro National University Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU

<p>April 2023, part 1, October 2023, Section 2</p>	<p>International Scientific Conference "Innovative Technologies, Cybersecurity Management Models ITMK-2023"</p>	<p>Dnipro, University of Customs and Finance Co-organizer: S.P. Timoshenko Institute of Mechanics of the NASU</p>
<p>November 14- 16, 2023</p>	<p>International Scientific Conference "Actual Problems of Mechanics" (to the 145th anniversary of the birth of S.P. Timoshenko)</p>	<p>S.P. Timoshenko Institute of Mechanics of the NASU Co-organizers: National Committee of Ukraine for Theoretical and Applied Mechanics M.S. Polyakov Institute of Geotechnical Mechanics of the NASU Institute of Technical Mechanics of the NASU and State Space Agency of Ukraine Institute of Hydromechanics of the NASU G.S. Pysarenko Institute for Strength Problems of the NASU Yuzhnoye Design Bureau named after M.K. Yangel Pidstryhach Institute of Applied Problems of Mechanics and Mathematics of the NASU V.M. Glushkov Institute of Cybernetics of the NASU Taras Shevchenko National University of Kyiv NTUU "Igor Sikorsky Kyiv Polytechnic Institute" National Transport University of Ukraine Dnipro National University named after Oles Honchar</p>

6.2. List of other conferences, scientific and public events in which the Institute's researchers were speakers

Date conducting	Name and type of event	Venue (city, Institute)
18-23 June, 2017	14th International Conference on Fracture	International Congress on Fracture (ICF) , Rhodes, Greece
11-13 October, 2017	11th International Conference "Shell Structures: Theory and Applications" (11th SSTA)	University of Gdańsk, Gdansk, Poland.
17-20 June 2018	First International Conference on Theoretical, Applied and Experimental Mechanics	Editor: E.E. Gdoutos, Paphos, Cyprus.
September 11-13, 2018	2nd International Conference on Pure and Applied Mathematics (ICPAM-VAN 2018)	Van, Turkey.
June 23-26, 2019	Second International Conference on Theoretical, Applied and Experimental Mechanics (ICTAEM 2019)	Corfu, Greece.
May 16-18, 2020	4th International Scientific and Practical Conference «Scientific Research in XXI Century»	Ottawa, Canada
2017, 2019, 2021, 2023 year	International Scientific Conference "Modern Problems of Mechanics"	Kyiv, Taras Shevchenko National University of Kyiv
2017, 2018, 2020	International Scientific and Practical Conference "Mathematics in the Modern Technical University"	Kyiv, National Technical University of Ukraine, Igor Sikorsky "Kyiv Polytechnic Institute".
2018, 2023	International Scientific Conference "Modern Problems of Mechanics and Mathematics"	Lviv, Institute of Applied Problems of Mechanics and Mathematics. Y.S. Pidstryhach of the NASU
2017, 2020, 2021 year	Scientific and Technical Conference "Informatics, Mathematics, Automation"	Sumy, Sumy State University Sumy – Nur – Sultan (2021)
2017, 2018, 2019	International Scientific and Practical Conference "Actual Problems of Engineering Mechanics"	Odesa, Odesa State Academy of Civil Engineering and Architecture.
2018, 2020	International Scientific Conference "Modern Problems of Mathematical Modeling, Forecasting and Optimization"	Kamianets-Podilskyi, Kamianets-Podilskyi Ivan Ohienko National University.

6.3. Public Relations

Website and Publications:

- Information about the activities, achievements, and staff of the Institute is regularly published on the Institute's website, the NASU website, and in the International Scientific Journal "Applied Mechanics".

Key Achievements and Publications:

1. 100th Anniversary Celebrations:

○ International Scientific Journal "Applied Mechanics" (2019):

- **Issue No. 1:** Published a congratulatory message from Andriy Parubiy, Chairman of the Verkhovna Rada of Ukraine, praising the Institute's global recognition and practical applications.
- **Issue No. 2:** Included greetings from B.E. Paton, President of the NASU, highlighting the Institute's significant contributions to various fields of mechanics and its impact on Ukraine's scientific and technical potential.
- **Issue No. 3:** Reported awards received by Institute scientists from the Yuzhnoye Design Bureau for their contributions to rocket and space technology.

2. Recognition and Awards:

- Acknowledgment of scientists who received awards from the Presidium of the NASU for significant contributions to mechanics and related fields.
- Awards from Yuzhnoye Design Bureau for contributions to structural strength and reliability in rocket and space technology.

3. Scientific Articles and Publications:

○ 2023:

- **Anatolii Khoroshun:** Published an article on "Analytical Methods of Qualitative Analysis of Motion Control Problems of Nonlinear Mechanical Systems with Inaccurate Parameters" on the NASU website.
- **Vyacheslav Bogdanov:** Authored several articles:
 - "On the activities of the Institutes of the Section of Physical, Technical and Mathematical Sciences of the NASU during martial law" (Journal "Bulletin of the NASU", No. 3, 2023).
 - "Development of mechanics in the NASU through the prism of Institutes of the Department of Mechanics of the NASU" (Journal "Bulletin of the NASU", No. 10, 2023).
 - "Scientific Shield of the Unbreakable" about Academician Borys Paton's role in state defense research (Information TV channel "We are Ukraine").

4. Notable Articles and Publications:

- **December 22, 2020:** An article by Igor Brovchenko and Igor Ivanov on mathematical modeling of SARS-CoV-2 published by "Mirror of the Week".
- **2018-2019:** Articles celebrating the 80th anniversary of Academician Alexander Nikolaevich Guz, including contributions from V.L. Bogdanov and L.A. Dubrovina, and O.P. Zhuk.

5. Popularization of Science:

- **Volodymyr Maksymiuk:** Published a series of articles in collaboration with other Institute staff, contributing to the popularization of science:
 - Maksymiuk, V.A. "To the Genesis of the Theory of Value: From Work to Energy" // Economic Heritage of K. Marx: A View Through the Prism of Centuries. All-Ukrainian materials. Round table; April 25, 2018. Kyiv: KNEU, 2018. – 124 p. – P. 62–64.

- Maksymiuk V.A. "Ekonomichna teoriia z pohliadu fiziky" [Economic theory from the point of view of physics]. Sci.-Pract. Conf. (May Kyiv, 28-29, 2019). – Kyiv : Kyiv. National. Trade.-Econ. Univ., 2019. – P. 60–65.
- Maksymiuk V.A. "On Sources and Measures of Value from the Point of View of Physics" // Fundamental Economic Theory in the Structure of Economic Knowledge: Problems and Challenges of the Present. All-Ukrainian materials. Round table; November 7, 2019. Kyiv: KNEU, 2019. — 199 p. – P.180–184.
- Maksymiuk V.A., Fetisov I.B. Research of the intensity and duration of sounds of rhythmic accompaniment on the drum of playing "Ukrainian hopak" // Art Studies Studies. –K: IMFE, 2019. – №1. – P. 7–18.
- Maksymiuk V.A., and Maksymiuk, N.V. "On the algorithm for calculating the dew point based on the Goff formula" // Collection of materials of the All-Ukrainian Correspondence Scientific and Practical Internet Conference "Applied Mathematics and Computer Science", Mariupol, February 28, 2020. – Mariupol: Donetsk State University of Management, 2020. – P. 13 – 16.
- Anikiev I.I., Maksymyuk V.A., Sushchenko E.O., Fetisov I.B. On measurement of dynamic pressure in the percussion pipe and musical instruments with the WIKA A-10 sensor. Mechanics 2021.– 57, No5. – P. 87 – 98.
- Maksymiuk V.A. "On Threats, Challenges and Rescue" // S. Podolynsky, V. Vernadsky, M. Rudenko — devotees of natural sciences of economic thinking and management Kyiv. 2020. — K.: KNEU, 2020. — 71 p. S. 33–37.
- Maksymiuk V.A. "On Physical and Economic Models of Mykola Rudenko" // Collection of Materials of the V All-Ukrainian Scientific and Practical Conference "Modern Information Technologies, Automation Tools and Electric Drive", Kramatorsk, April 23 – 24, 2021 – Kramatorsk: DSMA, 2021. – P. 120 – 123.
- Maksymiuk V. A. "Idei Sergiy Podolynskiyi u svitovoho vymiri" [Ideas of Sergiy Podolynsky in the World Dimension] // Sergiy Podolynskiyi – the founder of natural principles of thinking and economic management in the national and world economic science [Electronic resource]: theses of the round table, Kyiv, 23 June. 2021 – K: KNEU, 2021. – P. 46–49.
- Maksymiuk V.A., Fetysov I.B. On Scientific and Artistic Aspects of Measuring Dynamic Pressure // Collection of Materials of the III International Scientific and Technical Internet Conference "New Technologies in Education, Science and Production", Pokrovsk, April 29 – 30, 2021 – Pokrovsk: State Higher Educational Institute "DonNTU", 2021. – P. 146 – 150.
- Volodymyr Maksymiuk. The Law of Universal Gravitation in the Form of Radii of Monads by Mykola Rudenko // Worldview. – 2021. – 16(4). – P.33.
- Maksymiuk V.A. On the self-sufficiency of physical models of Mykola Rudenko // "... Humanity is the active organ of the Universe" - Mykola Rudenko about Hryhorii Skovoroda. [Electronic resource]: theses of the Round Table, Kyiv, December 15, 2022. – Kyiv: KNEU, 2023. — 50 p. P. 15–19.

7. Significance and Relevance of the Institute's Activities for Socio-Economic and Humanitarian Development

1. Advancement of Fundamental Knowledge:

- The Institute's research contributes to a deeper understanding of mechanical phenomena, including material properties, structural behavior under various loads, and the effects of different physical fields (acoustic, electromagnetic, etc.) on mechanical systems. This fundamental knowledge drives innovation and informs practical applications across multiple sectors.

2. Contributions to National Security and Defense:

- The Institute's work supports national security and defense by providing advanced research and development in areas critical to these fields. Collaborations with Institutes such as:
 - **Ukrainian Research Institute of Special Equipment and Forensic Expertise of the Security Service of Ukraine**
 - **Central Research Institute of Armament and Military Equipment of the Armed Forces of Ukraine**
 - **Design Bureau "Yuzhnoye" named after M.K. Yangel**
 - **State Research Institute for Testing and Certification of Weapons and Military Equipment**
 - **E.O. Paton Institute of Electric Welding of the NASU**
- These collaborations help in the development of new technologies and improvements in existing systems that enhance the nation's defense capabilities.

3. Impact on Medical and Cultural Sectors:

- **Medical Sector:**
 - The Institute's research contributes to advancements in medical technology and diagnostics through partnerships with Institutes such as Kyiv National Medical University. O.O. Bogomolets. This includes developing new methods and materials that can improve medical equipment and treatments.
- **Cultural Sector:**
 - Collaboration with the National Center of Folk Culture "Ivan Honchar Museum" has led to significant contributions in the study of acoustic properties and musical instruments. This research aids in preserving and understanding cultural heritage.

4. Industrial and Technological Applications:

- **Oil Refining and Space Industries:**
 - The Institute's research supports technological advancements in oil refining and space industries. For example, patents and implementation acts demonstrate the practical application of research results in industrial processes and technologies.
- **Locomotive and Transportation:**
 - Cooperation with the Joint Stock Company "Ivano-Frankivsk Locomotive Repair Plant" ensures that research outcomes contribute to improving the performance and reliability of transportation infrastructure.

5. Innovation and Practical Applications:

- Patents and implementation acts reflect the Institute's success in translating research into practical solutions and technologies. Examples include:
 - **Patent for determining mechanical properties of materials and methods for assessing fatigue limits**
 - **Act of Implementation for Yuzhnoye Design Bureau and National Energy Generating Company**

Overall, the Institute's research plays a vital role in driving technological innovation, enhancing national security, improving medical and cultural sectors, and supporting industrial advancements. Its collaborations and practical implementations underscore its significant impact on the socio-economic and humanitarian development of Ukraine.

8. Cooperation and System of Scientific Relations of the Institute

8.1. Cooperation with Educational Institutes

1. Expansion of Relations with Higher Educational Institutes:

- The Institute emphasizes expanding its collaboration with universities to enhance the training of highly qualified scientific personnel and promote mechanics among students. This includes preparing joint monographs and textbooks, and providing pedagogical training.

2. Cooperation Agreements:

- **Kyiv National University Taras Shevchenko**
- **National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"**
- **National University of Life and Environmental Sciences of Ukraine**
- **Oles Honchar Dnipro State University**
- **Uman State Pedagogical University**
- Students from these Institutes engage in production and pre-diploma practices at the Institute, and Institute graduate students undertake pedagogical practices at these universities.

3. Long-Term Collaboration:

- Since 2011, the Institute has collaborated with the **National Aviation University** on research related to fatigue resistance and fracture of aluminum alloys. This agreement, though interrupted for a year in 2022, remains active.

4. Teaching Activities:

- **Selivanov M.F.** and **Zhuk Y.O.** have taught at Kyiv National University Taras Shevchenko.
- **Chornoivan Y.O.** has taught at Kyiv National University of Construction and Architecture and Kyiv National University named after T.G. Shevchenko. He also prepared lectures, methodical manuals, and course programs.
- Between 2017-2020, **Kyryliuk V.S.**, a professor at the National Transport University, taught "Program and Data Security" and "Information Security Technologies," guiding ten master's theses.
- **Khoroshun A.S.** has collaborated with the National University of Life and Environmental Sciences of Ukraine on developing educational programs and engaging in joint research.
- **Yanchevsky I.V.**, a leading researcher, teaches theoretical and technical mechanics at the National Technical University of Ukraine "KPI," supervises graduate theses, and is a consultant on a doctoral dissertation.

5. Joint Publications and Research:

- **Grigorenko O.Y.**, **Muller W.H.**, and **Loza I.A.** prepared the monograph "Selected Problems in the Elastodynamics of Piezoceramic Bodies," published in *Advanced Structured Materials*, Vol. 154, Cham: Springer Nature Switzerland AG, 2021.
- **Grigorenko O.Y.** was a scientific consultant for doctoral dissertations at Lviv National University and National Transport University.
- The Institute has also contributed to the preparation of textbooks, methodological guidelines, and scientific articles.

6. Textbooks and Methodological Guidelines:

- The staff prepared 3 textbooks, 21 textbooks, and 32 methodological guidelines.

- Collaborative efforts led to the publication of 5 monographs and numerous scientific articles cited in leading databases such as Scopus and Web of Science.

7. Role in Pedagogical Development:

- The Institute's involvement in educational activities not only contributes to the academic growth of students but also enhances the integration of advanced research into educational programs. This collaboration ensures that the next generation of scientists and engineers is well-equipped with both theoretical knowledge and practical experience.

In summary, the Institute's collaboration with educational Institutes significantly contributes to the development of future scientists and engineers, the advancement of educational programs, and the dissemination of research findings. This cooperation is integral to both academic and practical advancements in the field of mechanics.

8.2. Cooperation with Other Institutes in Ukraine

- **Yuzhnoye Design Bureau, State Enterprise:** Collaboration included research on the project "Dynamics and Strength of Shells of Rotation" (I.2017 – IV.2017) under research work No. 151-2017, supervised by NASU academician V.D. Kubenko, and the project "Problems of Composite Materials" (I.2017 – IV.2017) under research work No. 152-2017, supervised by NASU academician O.M. Guz. Additionally, an Agreement on Scientific Cooperation was established between the Yuzhnoye Design Bureau named after M.K. Yangel and the Institute of Mechanics named after S.P. Timoshenko of NASU (01.09.2022 – 31.08.2024).
- **E.O. Paton Institute of Electric Welding of the NASU:** Between 2017 and 2020, the Institute collaborated within the framework of the NASU Target Program of Scientific Research "Reliability and Durability of Materials, Structures, Equipment and Structures" (RESURS-2), which was approved by the NASU Presidium's Resolution No. 293 on 16.12.2015, No. 369 on 27.12.2017, and Order No. 71 on 05.02.2018.
- **Ministry of Education and Science of Ukraine:** Following the results of a competition, the Institute's departments conducted several research projects under code 6541230 based on agreements with the Ministry. In 2018, five projects were implemented, followed by five in 2019, three in 2020, three in 2021, two in 2022, and two in 2023.
- **National Research Foundation of Ukraine:** In 2020, 2021, and 2023, the Institute executed Contract No. 195/02.2020/34 on the project "Diffraction Processes and Radiation Forces in Confined Hydroelastic Systems."
- **Ukrainian Research Institute of Special Equipment and Forensic Expertise of the Security Service of Ukraine:** An agreement on cooperation and interaction in scientific and technical activities was signed to facilitate scientific and applied research, implement research findings, and utilize testing and measuring equipment. One significant outcome of this agreement was the experimental optimization of the water bullet trap parameters used in forensic examinations to identify weapons by bullet markings.
- **Central Research Institute of Armament and Military Equipment of the Armed Forces of Ukraine:** Under Agreement No. 08/2019 on scientific and technical cooperation, studies were conducted on the physical and mechanical characteristics of fragments from Russian missiles and shells. Joint research also involved examining structural elements and electronic components of the Shahed-136 (Geran-2) UAV, which helped strengthen the evidence base confirming the production of the UAV in Iran. For the first time, the Institute conducted a comprehensive analysis of the

physicochemical composition, structure, and surface topography of fragments from specialized structures made of both metallic and composite materials using scanning electron microscopy. This research contributed to the development of an automated identification system for special-purpose structures based on international classifications and country of origin.

- **Scanning Electron Microscopy:** The Institute utilized scanning electron microscopy to examine the microstructural characteristics of metals used in the components of cruise and aircraft missiles, as well as guided rockets from the aggressor country. The studies employed a JXA-8200 X-ray microanalyzer by JEOL Ltd (Japan) and a JSM-6490LV scanning electron microscope with the INKA Energy 350XT energy dispersive spectrometer. Key findings included analyses of engine fragments from the 3M14 Kalibr cruise missile, bodies of the R-37 and R-31 air missiles, and the P-800 Onyx anti-ship missile.
- **State Research Institute for Testing and Certification of Weapons and Military Equipment:** An agreement on scientific and technical cooperation was established to support research related to the development and implementation of modern weapons and military equipment for the Armed Forces of Ukraine.

8.3. Cooperation with Foreign Scientific Institutes

The Institute's international cooperation with foreign scientific Institutes, organizations, and universities is driven by mutual interest in the published research results of its staff and foreign scientists. Many specialists trained by the Institute now work at leading universities in Austria, the UK, France, Germany, Italy, Mexico, and Turkey, maintaining close contact with the Institute and publishing joint research results in both foreign and domestic journals.

Cooperation Agreements:

- The Institute has formal cooperation agreements with several foreign Institutes, including the University of Aberdeen (UK), the Technical University of Berlin, Otto von Guericke University of Magdeburg (Germany), and the Australian National University. These agreements encompass coordinated research in priority areas of mechanics, the preparation and publication of scientific articles, and the exchange of research findings.

Informal Collaborations:

- Without specific agreements, the Institute also collaborates with scientific Institutes in various countries, including Austria, Azerbaijan, Belgium, Bulgaria, Armenia, Greece, the Netherlands, Estonia, Israel, Spain, Kazakhstan, Canada, Latvia, Lithuania, Slovakia, the Czech Republic, Sweden, Hungary, Uzbekistan, France, and China.

Participation in Conferences and Symposia:

- Scientists from the Institute frequently engage in international conferences and symposia, both in Ukraine and abroad, to foster international collaboration. During the reporting period, 34 scientists from the Institute traveled abroad, including:
 1. Dr. O.Y. Grigorenko visited the Technical University of Berlin, Germany, to conduct joint research on the dynamics of piezoceramic cylinders.
 2. In 2017, Dr. V.I. Slynko was a visiting scientist at Van Yuzuncu Yil University, Turkey, under a project by the Turkish Scientific and Technological Research Council. In 2018, he was an invited speaker and member of the Scientific Committee of the International Scientific Conference ICPAM-2018 in Van, Turkey. From October 2019 to December 2023, he interned at the Institute of Mathematics at the University of Würzburg, Germany.
 3. In 2023, Dr. A.S. Khoroshun participated in the Ukrainian-Israeli research project "Development of New Modifications of the PSO Optimization Method and Their Application in Engineering Problems" (No. 0123U103322) under Contract M/67-2023 dated 29.08.2023.
 4. Dr. I.O. Guz conducted research in Edinburgh, UK, focusing on mechanics.
 5. Dr. L.V. Nazarenko carried out joint research with the Technical University of Berlin and Otto von Guericke University of Magdeburg in Germany.

6. In 2021, Dr. M.F. Selivanov conducted collaborative research at Otto von Guericke University in Magdeburg, Germany.

7. NASU academician O.M. Guz provided scientific consultations in Edinburgh, UK.

International Projects:

- The Institute has been involved in long-term collaborative projects with the Technical University of Berlin and Otto von Guericke University of Magdeburg, Germany. Head of the Department, Dr. Oleksandr Hryhorenko, has conducted joint research and delivered presentations at these German universities.
- Contracts were signed for the publication of monographs with the international publisher Springer, including works commemorating the 145th anniversary of NASU academician Stepan Timoshenko and the 95th anniversary of NASU academician Yaroslav Hryhorenko.
- Dr. V.L. Bogdanov, Head of the Department of Dynamics and Stability of Continuums and NASU academician, co-leads a joint project between NASU and the International Institute for Applied Systems Analysis (IIASA, Austria).
- NASU Corresponding Member Dr. J.J. Rushchytzky participated in the NATO Science for Peace and Security Program projects, including "Building Knowledge for Geohazard Assessment and Management in the Caucasus and Other Orogenic Regions" (2016-2019) and "Prevention of Geo-Threats in Azerbaijan's Energy" (2022-2025), involving scientists from six countries: Belgium, Italy, the Czech Republic, Georgia, Azerbaijan, and Ukraine.
- In 2023, Dr. P.V. Fernati received a grant for modeling crack growth in viscoelastic orthotropic materials, partnering with Institutes including the Australian National University.
- The Department of Process Stability collaborates with the Institute of Applied Mathematics of Baku State University on "Optimization of Control Systems."

Publications and Conferences:

- The Institute's researchers publish articles in top-rated international journals and participate in international conferences. Notably, the "Actual Problems of Mechanics – 2023" international scientific conference, dedicated to the 145th anniversary of NASU academician Stepan Timoshenko, was held in Kyiv, Dnipro, Lviv, and Kharkiv in a mixed format. The event was organized by the Institute of Mechanics and the National Committee of Ukraine for Theoretical and Applied Mechanics, featuring presentations by domestic and international experts, including Professor Holm Altenbach of the University of Magdeburg, who highlighted Timoshenko's contributions to modern engineering education.

International Scientific Journal "Applied Mechanics":

- The Institute publishes the international journal "Applied Mechanics," which is translated into English by Springer and has a respectable rating (quartile Q4). The journal's editorial board includes renowned scientists from Austria, Azerbaijan, Armenia, Estonia, China, Mexico, Germany, and Slovakia, contributing to the expansion of the Institute's international collaboration.

8.3.1. Participation of the Institute's researchers in international Institutes

Scientists from the Institute are actively involved in international organizations through memberships in foreign academies of sciences and scientific societies. They contribute significantly to the global scientific community by participating in editorial boards, leading projects, and publishing joint research.

Key International Affiliations:

- **Academician O.M. Guz** serves as an Advisor to the Directorate and is a member of the Academy of Europe, a Fellow of the New York Academy of Sciences, and a founding member of the World Academy. He is on the editorial boards of several international journals, including "Applied Mechanics Review" (USA), "Applied Mathematics and Mechanics" (China), "Theoretical and Applied Mechanics" (Bulgaria), and "Mechanics of Composite Materials" (Latvia).
- **Academics O.M. Guz and A.A. Martynyuk** are editorial board members of the international monograph series "Stability, Oscillations, and Optimization of Systems" published by Cambridge Scientific Publishers, UK.

- **Dr. V.L. Bogdanov**, Head of the Department of Dynamics and Stability of Continuum, co-leads a joint project between NASU and the International Institute for Applied Systems Analysis (IIASA) in Austria.
- **Dr. J.J. Rushchitsky**, Head of the Department of Rheology and NASU Corresponding Member, is involved with numerous international organizations, including ASME (since 1998), GAMM (since 1993), EUROMECH (since 1995), the New York Academy of Sciences (since 1995), and the American Nano Science Society (since 2010). He also serves on the editorial boards of several international journals, such as *International Applied Mechanics* (Kyiv-New York, Springer Group) and *Waves, Wavelets, Fractals: Advanced Analysis* (Rome-Warsaw, De Gruyter).
- **Academician A.A. Martynyuk**, Head of the Department of Process Stability, is the Editor-in-Chief of the international journal "Nonlinear Dynamics and Systems Theory" (Ukraine, Australia) and serves on the editorial boards of multiple English-language journals, including *International Applied Mechanics* (USA) and *Differential Equations and Dynamical Systems* (Germany).

Additional Notable Affiliations:

- **Academician V.D. Kubenko**, Head of the Department of Oscillation Theory, is a member of the European Academy of Sciences and Arts and the New York Academy of Sciences.
- Six scientists from the Institute, including Dr. V.P. Golub, Dr. I.O. Guz, Dr. A.O. Kaminsky, and Dr. I.K. Senchenkov, are members of the New York Academy of Sciences.
- **Dr. O.Y. Grigorenko**, NASU Corresponding Member, collaborated with scientists from Otto von Guericke University, Magdeburg, and the Technical University of Berlin, Germany, resulting in the joint monograph: *Selected Problems in the Elastodynamics of Piezoceramic Bodies* (Springer Nature Switzerland AG, 2021).

Researcher Contributions:

- **Dr. Y.O. Zhuk**, a Leading Researcher in the Department of Thermoelasticity, is on the editorial board of the journal "Composites and Advanced Materials" (UK), indexed in Scopus.
- **Dr. V.B. Larin** was an editor-in-chief of "Applied and Computational Mathematics" (Baku, Azerbaijan), and serves on the editorial board of the TWMS Journal of Pure and Applied Mathematics (Baku, Azerbaijan).
- **Dr. V.V. Zozulya** and **Dr. I.O. Guz**, Leading Researchers, are members of the International Editorial Board of the *International Scientific Journal "Applied Mechanics"*. Dr. I.O. Guz is also on the editorial board of *Archive of Applied Mechanics* (Springer).
- **Dr. M.Y. Kashtalyan** from the Department of Rheology is the editor-in-chief of *Applied Composite Materials* (Springer).

Editorial and Publishing Activities:

- The Institute publishes the international scientific journal "Applied Mechanics," which is translated into English by Springer as "International Applied Mechanics." The journal's editorial board features scientists from Austria, England, Italy, Mexico, Germany, Russia, the USA, and more, facilitating extensive international collaboration and dissemination of research findings.

Through these activities, the Institute's scientists significantly contribute to global scientific discourse, fostering international collaboration and the exchange of knowledge across borders.

8.3.2. International scientific	Number of researchers who traveled outside	including for the purpose of	Quantity	In the mean time, Among	Number of researchers who benefited from the
---------------------------------	--	------------------------------	----------	-------------------------	--

and technical cooperation of researchers of the Institute, Years	Ukraine, persons	internships, training, advanced training	Teaching Work	conducting scientific research	trips of researchers outside Ukraine in order to participate in international seminars, conferences, etc., units	international conferences, seminars, etc., held by the Institute, units	grants received for scientific work from the international funds, units	grant, persons	
								Individual	Collective
2017	5	1		4		2	1		
2018	5	1		2	2	1	1		
2019	5	2		2	1	3	1		
2020	4	2		2		3			
2021	4	2		2		1			
2022	6	2	1	2	1	2	1		1
2023	5	2	1	2		3	2		7
Just	34	12	2	16	4	15			

8.4. Other Important Types of Collaboration and Communication

For a considerable period of time, the Institute (seven departments in different areas) has been cooperating on a bilateral basis with Yuzhnoye SDO. M.K. Yangel". We also cooperate with such mass media as the website of the NASU, the journals "Bulletin of the NASU", and "Worldview".

9. Training Scientific Personnel, Providing Advanced Training for Institute's Employees, and Supporting the Career Growth of Young Scientists

9.1. Training of scientific personnel

9.1.1. Postgraduate and doctoral activities of the Institute	PhD students							Doctoral students						
	2017	2018	2019	2020	2021	2022	2023	2017	2018	2019	2020	2021	2022	2023
Quantity – Total including at the expense	7	4	7	6	6	1	5	4	4		1			1
of the State Budget	4/3	3/1	6/1	6	6	1	3	4	4		1			1
Other sources							2							
Graduation with the		1			1				1			1		

defense of the dissertation														
in % of the total number of people who completed their studies		20			100				33			100		
Dissertation defense Search engines		3		3				1	3					

Between 2017 and 2019, graduate students received on-the-job training funded by the state budget.

9.1.2. Training of Scientific Personnel by Researchers of the Institute (who work in the Institute at the main place of work)

During the reporting period, 12 researchers supervised graduate and doctoral students, which is approximately 11% of the total number of researchers at the Institute.

Indicators	2017	2018	2019	2020	2021	2022	2023
Number of researchers of the Institute who supervised postgraduate and doctoral students	8	7	6	7	8	6	6
The total number of researchers at the Institute	103	106	106	105	105	110	116
in % of the total number of researchers in the Institute	7,8	6,6	5,7	6,7	7,6	5,5	5,2

9.1.3. Advanced Training of the Institute's Researchers

Indicators	2017	2018	2019	2020	2021	2022	2023	Just
Number of researchers of the Institute who received:								
Degree of Doctor of Philosophy (Candidate of Sciences)	1	1	1		2			5
in % of the total number of researchers of the Institute	0,97	0,94	0,94		1,9			4,66
PhD Degree	1		3		1			5
in % of the total number of researchers at the Institute	0,97		2,82		0,95			4,66
Academic title of Senior Researcher (Senior Researcher)						1		1
in % of the total number of researchers at the Institute						0,93		0,93

9.2. The number of researchers of the Institution who became laureates of state and international awards (in the field of natural, social and humanitarian sciences) and who were awarded honorary titles of Ukraine during the reporting period.

International and State Awards

1. **Academician O.M. Guz:**
 - **2017 Albert Nelson Marquis Lifetime Achievement Award** by the Biographical Center "Who's Who in the World."
2. **Academician O.M. Guz and Doctor O.P. Zhuk:**
 - **Prize named after O.K. Antonov of the NASU** for a series of papers on "Dynamics of a Compressible Viscous Liquid" (2017).
3. **Academician Y.M. Grigorenko:**
 - **Title of "Honored Worker of Science and Technology of Ukraine"** by the Decree of the President of Ukraine No. 135/2018 (May 19, 2018).
4. **Academician V.L. Bogdanov:**
 - **Order of Prince Yaroslav the Wise, V degree** for significant contributions to national science and technical potential (2018).

Awards and Honors for the 100th Anniversary of the NASU:

1. **Diplomas of the Verkhovna Rada of Ukraine:**
 - Awarded to **Scientific Secretary O.P. Zhuk, Corresponding Members J.J. Rushchitsky and L.P. Khoroshun, and I.S. Chernyshenko.**
2. **Diploma of the Verkhovna Rada:**
 - Awarded to **Corresponding Member V.M. Nazarenko.**
3. **Jubilee Certificate of Honor:**
 - Awarded to **O.M. Sytnik.**
4. **Award of the NASU "For Scientific Achievements":**
 - Awarded to **O.P. Zhuk, O.Z. Galishin, V.P. Golub, A.O. Kaminsky, V.G. Karnaukhov, and P.Z. Lugovoi.**
5. **Award of the NASU "For the Preparation of Scientific Change":**
 - Awarded to **Academician O.M. Guz and O.Y. Grigorenko.**
6. **Award of the NASU "For Professional Achievements":**
 - Awarded to **E.I. Beshpalova, O.Z. Galishin, B.M. Kiforenko, and V.F. Meish.**
7. **Certificate of Honor by the Presidium of the NASU and Central Committee of the Trade Union of Workers of the NASU:**
 - Awarded to **Ph.D. N.Y. Tkachenko.**
8. **Commemorative Award in Honor of the 100th Anniversary of the NASU:**
 - Awarded to **Academician Y.M. Hryhorenko, Corresponding Member I.S. Chernyshenko, N.M. Bek, and Ph.D. O.O. Khotenko.**
9. **Gratitude by the Presidium of the NASU:**
 - Awarded to **O.A. Myronenko.**

Awards from the Yuzhnoye Design Bureau:

1. **Medal "Chief Designer M.K. Yangel":**
 - Awarded to **Academics O.M. Guz and V.L. Bogdanov.**
2. **Medal "For Personal Contribution to Joint Space Research":**
 - Awarded to **Academician V.D. Kubenko.**
3. **Medal of Merit:**
 - Awarded to **Academician A.A. Martynyuk.**
4. **Badge "For the Creation of Rocket and Space Technology":**
 - Awarded to **Academician O.M. Guz.**

Borys Paton National Prize of Ukraine:

- **Dr O.M. Bagno and Dr O.P. Zhuk** (as part of the team) for work on "Dynamic Interaction of Solid Deformable Bodies with Liquid" (Decree of the President of Ukraine No. 660/2021, December 16, 2021).

9.3. The Number of Researchers at the Institute Who Were Elected as Academicians and Corresponding Members of the National and Sectoral Academies of Sciences, as well as Members of Foreign Academies of Sciences During the Reporting Period

Elected Academicians and Corresponding Members:

1. **V.M. Nazarenko:**
 - Elected **Academician** of the NASU, Department of Mechanics and Mechanical Engineering, specialty: Mechanics (26.05.2021).
2. **O.Y. Grigorenko and Y.O. Zhuk:**
 - Elected **Corresponding Members** of the NASU, Department of Mechanics and Mechanical Engineering, specialty: Mechanics (26.05.2021).

9.4. Career Growth of Young Scientists

9.4.1. Statistical Data on Young Scientists

	2017	2018	2019	2020	2021	2022	2023
Young scientists, <i>total, persons</i>	18	10	10	6	7	5	8
in % of the total number of researchers of the Institute	17,48	9,43	9,43	5,71	6,67	4,55	6,90
including women, <i>persons</i>	7	3	3	2	-	-	-
in % of the total number of researchers of the Institute	6,80	2,83	2,83	1,90	-	-	-
Doctors of Philosophy (Candidates of Sciences) up to 35 years, <i>persons</i>	3	3	4	3	3	2	2
in % of the total number of researchers at the Institute	2,91	2,83	3,77	2,86	2,86	1,82	1,72
Doctors of Sciences, up to 40 years, <i>persons</i>	2	2	2	2	1	1	-
in % of the total number of researchers of the Institute	1,94	1,89	1,89	1,90	0,95	0,91	-

9.4.2. Young Scientists Who Received State Prizes, Scholarships, and Grants for Young Scientists

Presidential Scholarship for Young Scientists of Ukraine:

- Awarded to:
 - **One postgraduate student**
 - **Seven candidates of sciences**
 - **One doctor of sciences**

Scholarship Named After Academician B.E. Paton:

- Awarded to:
 - **One doctor of sciences** (for young scientists of the NASU)

NASU Grants:

- For young scientists in the laboratory (joint research with the Institute of Applied Mathematics and Mechanics of the NASU):
 - **Two doctors of sciences**
- For scientific research:
 - **Three candidates of sciences**
 - **One doctor of sciences**

NASU Scholarships:

- Awarded to:
 - **Three postgraduate students**
 - **Seven candidates of sciences**
 - **One doctor of sciences**

Additional Honors:

- **M.Y. Borysenko** received:
 - Title of "Doctoral Student of the Year in the Field of Physical, Technical and Mathematical Sciences" (certificate No. 0288, dated 05.10.2022, RMU at the Ministry of Education and Science of Ukraine)
 - State scholarship to the best young scientists for 2023 (order of the Ministry of Education and Science of Ukraine No. 1047, dated 18.11.2022) to honor the events of the Revolution of Dignity and the Heroes of the Heavenly Hundred.
- **PhD student B.V. Timoshenko** received:
 - Scholarship from the German Academic Exchange Service (DAAD) for full-time study at the Institute of Mathematics of the Julius Maximilian University of Würzburg.

Name of Award/Grant/Incentive	Recipient's full name	Year
Grants for research work for young scientists of the NASU	Ph.D. Anatoly Khoroshun, Ph.D. Yaroslav Pavlyuk	2017
Scholarships of the President of Ukraine	Ph.D. Igor Ivanov, Candidate of Physical and Mathematical Sciences Oksana Vovkodav, Ph.D. Yaroslav Pavlyuk	2016–2018
Scholarships of the NASU	Doctor of Physical and Mathematical Sciences Vitaliy Slynko, Ph.D. Mykhailo Dovzhyk, Ph.D. Anatoly Khoroshun	2016–2018
Grant for research work for young scientists of the NASU	Ph.D. Yaroslav Pavlyuk	2018
Scholarships of the President of Ukraine	Candidate of Physical and Mathematical Sciences Vira Ragulina, Ph.D. Mykhailo Dovzhyk, Ph.D. Oleksandr Kipnis	2018 – 2022

Scholarships of the NASU	Ph.D. Igor Ivanov, Ph.D. Yaroslav Pavlyuk, postgraduate student Volodymyr Pelykh	2018– 2020
Grant of the NASU for young scientists in the laboratory	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun, Doctor of Physical and Mathematical Sciences Vitaliy Slynko	2018–2020
Grant for research work for young scientists of the NASU	Ph.D. Yaroslav Pavlyuk	2019
Grant of the NASU for young scientists in the laboratory of the Institute of Mechanics and the Institute of Problems of Mathematics	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2020
Scholarships of the President of Ukraine	PhD student Sergiy Orlenko, Doctor of Physical and Mathematical Sciences Anatoliy Khoroshun, Candidate of Physical and Mathematical Sciences Oleksandr Kipnis	2019–2021 2020–2022 2020–2022
Scholarships of the NASU	Ph.D. Ivanov Igor Lvovich, postgraduate student Volodymyr Pelykh, postgraduate student Valerii Chernienko	2020–2022 2020–2022 2020–2022
Grants for research work for young scientists of the NASU	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2020
Grants for research work for young scientists of the NASU	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2021
Scholarships of the President of Ukraine	Ph.D. Maxim Borisenko	2021–2023
Scholarships of the NASU	Ph.D. Vasyl Yurchuk, Ph.D. Oleksandr Kipnis, postgraduate student Viktoriia Protsan.	2022– 2024
Grants for research work for young scientists of the NASU	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2022
On a competitive basis, he received a scholarship from the German Academic Exchange Service (DAAD) for full-time study at the Julius Maximilian Institute of Mathematics of the University of Würzburg (under the guidance of the Head of the Department of Dynamical Systems and Control Theory, Doctor of Physical and Mathematical Sciences, Professor Sergiy Dashkovsky).	post-graduate student Bogdan Timoshenko	2022
"Doctoral Student of the Year in the Field of Physical, Technical and Mathematical Sciences" (certificate No. 0288 dated 05.10.2022, RMU at	Ph.D. Maksym Borysenko	2022

the Ministry of Education and Science of Ukraine), received a state scholarship to the best young scientists to perpetuate the events of the Revolution of Dignity and honor the feat of the Heroes of Ukraine - Heroes of the Heavenly Hundred for 2023 (order of the Ministry of Education and Science of Ukraine No. 1047 dated 18.11.2022).		
He became the winner of the competition for the scholarship named after Academician of the NASU B.E. Paton for young scientists of the NASU for 2023.	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2023
Scholarships of the NASU	Ph.D. In Physics and mathematics Oleksandr Ostos	2023–2025
Scholarship of the Verkhovna Rada of Ukraine for young scientists – doctors of sciences.	Doctor of Physical and Mathematical Sciences Anatoly Khoroshun	2023

10. Ensuring Gender Equality and Harmonious Distribution of Time Between Work and Family

The Institute has ensured gender equality in its recruitment processes. During competitions for scientific positions, all women who participated were successfully enrolled. Additionally, women constitute over 40% of the total number of researchers at the Institute, as detailed in Table 1.4.3.

11. Receipts and Expenditures of the Institute

11.1. Institute Receipts (2017 – 2020)

		2017			2018			2019			2020		
		K UAH	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH	% 1)	% 2)
Receipts of TOTAL		2248 2,6	100%		2421 6,0	100%		2665 3,9	100%		2869 7,2	100%	
1.	General Fund Receipts	1843 5,8	82,0	100%	2116 6,1	87, 4	100 %	2264 0,6	84, 9	100 %	2440 3,2	85,0	100%
1.	Basic funding of the Institute	1825 5,0	81,2	99,0	2103 3,9	86, 8	99,4	2255 7,1	84, 6	99,6	2429 2,3	84,6	99,5
1.	For the training of scientific personnel	156,5	0,7	0,8	109,2	0,5	0,5	61,9	0,2	0,3	90,9	0,3	0,4
1.	For financial support of scientific objects constituting a national treasure	-			-			-			-		
1.	For exhibitions and conferences	-			-			-			-		
1.	For the payment of contributions to international scientific organizations	24,3	0,1	0,2	23,0	0,1	0,1	21,6	0,1	0,1	20,0	0,1	0,1
2	Receipts of the special fund	4046, 8	18,0		3049, 9	12, 6		4013, 3	15, 1		4294, 0	15,0	
2.	Payment for services provided by budgetary Institutes in accordance with their main activity	119,2	0,5		673,8	2,8		101,8	0,4		517,7	1,8	
2.	Property Rental Fee	3826, 9	17,0		2301, 0	9,5		3816, 1	14, 3		3608, 3	12,6	
2.	Proceeds from the sale of property	-			-			-			-		
2.	Charitable contributions, grants and gifts (specify grant providers)	100,7	0,5		75,1	0,3		95,4	0,4		168,0	0,6	

11.1. Institute Receipts (2021 – 2022)

		2021			2022			2023		
		K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)
Receipts of TOTAL		37995,2	100%		33712,4	100%		35896,3	100%	
1.	General Fund Receipts	31208,5	82,1	100%	31781,0	94,3	100%	29415,9	81,9	100%
1.1.	Basic funding of the Institute	31060,8	81,7	99,5	31650,0	93,9	99,6	29355,0	81,7	99,8
1.1	For the training of scientific personnel	124,7	0,3	0,4	131,0	0,4	0,4	30,9	0,1	0,1
1.2	For financial support of scientific objects that constitute the national treasure	-			-			-		
1.3	For exhibitions and conferences	-			-			30,0	0,1	0,1
1.4	For the payment of contributions to international scientific organizations	23,0	0,1	0,1	-			-		
2	Receipts of the special fund	6786,7	17,9		1931,4	5,7		6480,4	18,1	
2.1	Payment for services provided by budgetary Institutes in accordance with their main activity	21,5	0,1		300,2	0,9		127,4	0,4	
2.3	Property Rental Fee	4368,0	11,5		1486,7	4,4		4578,0	12,7	
2.4	Proceeds from the sale of property	-			-			-		
2.5	Charitable contributions, grants, and gifts (specify grant providers)	2397,2	6,3		144,5	0,4		1775,0	5,0	

11.2. Expenditures of the Institute (2017 – 2020)

		2017			2018			2019			2020		
		K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)
Expenditures TOTAL		20647,3	100%		23740,5	100%		25229,3	100%		27280,8	100%	
1.	General Fund Expenditures	18255,0	88,4	100%	20942,5	88,2	100%	22337,7	88,5	100%	24292,3	89,0	100%
1.1	Salary with accruals	18246,6	88,3	99,9	20330,4	85,6	97,1	22312,8	88,4	99,9	24233,2	88,8	99,8
1.1	Payment for utilities and energy	-			-			-			-		
1.2	Purchase of items, materials, equipment and	8,4	0,1	0,1	307,1	1,3	1,5	24,9	0,1	0,1	59,1	0,2	0,2
1.3	Travel expenses	-			-			-			-		
1.4	Purchase of durable appliances and equipment	-			305,0	1,3	1,4	-			-		
2	Expenditures of the Special Fund	2392,3	11,6		2798,0	11,8		2891,6	11,5		2988,5	11,0	
2.1	Salary with accruals	146,6	0,7		539,1	2,3		134,2	0,5		210,0	0,7	
2.3	Payment for utilities and energy	1932,4	9,4		2205,6	9,3		2569,5	10,2		2595,0	9,6	
2.4	Travel expenses	8,0	0,1		10,5	0,1		13,0	0,1		20,0	0,1	
2.5	Purchase of items, materials, equipment and	305,3	1,4		42,8	0,1		174,9	0,7		163,5	0,6	

11.2. Expenditures of the Institute (2021 – 2023)

		2021			2022			2023		
		K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)	K UAH.	% 1)	% 2)
Expenditures TOTAL		36038,6	100%		35250,1	100%		33100,1	100%	
1.	General Fund Expenditures	31060,8	86,2	100%	31650,1	89,8	100%	28874,9	87,2	100%
1.1.	Salary with accruals	31033,3	86,1	99,9	31644,5	89,7	99,9	28874,9	87,2	100
1.1	Payment for utilities and energy	-			-			-		
1.2	Purchase of items, materials, equipment and inventory	27,5	0,1	0,1	5,6	0,1	0,1	-		
1.3	Travel expenses	-			-			-		
1.4	Purchase of durable appliances and equipment	-			-			-		
2	Expenditures of the Special Fund	4977,8	13,8		3600,0	10,2		4225,2	12,8	
2.1	Salary with accruals	770,0	2,1		130,2	0,4		898,2	2,7	
2.3	Payment for utilities and energy	3760,5	10,4		3341,8	9,4		3135,4	9,5	
2.4	Travel expenses	28,0	0,1		26,0	0,1		26,0	0,1	
2.5	Purchase of items, materials, equipment, and inventory	419,3	1,2		102,0	0,3		165,6	0,5	

11.3. The Number of Projects of the Institute Financed on a Competitive Basis from National Sources, and the Amount of Their Funding

№ Salary	Sources of funding	2017	2018	2019	2020	2021	2022	2023
1.	National Research Foundation of Ukraine (State subjects)				1	1		1
2.	Competitions of the NASU within the framework of the budget program 6541030 including	3	2	3	3	3	1	
2.1	Target Research Programs of the NASU	3	2	3	3	3	1	
2.2	Target research projects of the NASU							
2.3	Scientific and Technical Projects of the NASU							
2.4	Joint competitions of scientific projects of the NASU with international and foreign scientific organizations							
3.	Competitions of the NASU within the framework of the budget program of 6541230		1	1	3	3	2	2
3.1	Support of priority scientific research and scientific and technical (experimental) developments for the state		1	1	3	3	2	2
3.2	Conducting scientific research and scientific and technical (experimental) developments by young scientists through the creation of research laboratories (groups) of young scientists on a competitive basis	1						
3.3	Conducting joint international scientific research on a competitive basis.							1

11.4. The Number of Projects of the Institute Financed on a Competitive Basis from Foreign Sources, and The Amount of Their Funding

Source of funding, name of the project/grant	2017	2018	2019	2020	2021	2022	2023
1. Project G5566 "Building knowledge for geohazard assessment and management in the Caucasus and other orogenic regions" NATO Science for Peace and Security Series C: Environmental Security . 2016-2019 years	1	1	1			1	1
2. Project G5907 "Prevention of Geo-Threats to Azerbaijan's Energy Independence," in the framework of the NATO Science for Peace and Security Programme. 2022-2025 "Prevention of geo-threats to the energy independence of Azerbaijan", which is implemented within the framework of the NATO program "Ignorance for Peace and Security")							
Funding Source: Australian Academy of Science Grant "Crack growth modeling in viscoelastic orthotropic materials". 2022–2023)							1 (7350 Australian Dollars ~200 K UAH)

12. Implementation of Recommendations from the Last External Evaluation

In response to the recommendations provided in the 2017 external evaluation, the Institute has made notable progress, although some issues remain partially addressed:

1. Scientific Information Access:

- **Status:** The Institute has improved access to scientific information through the use of international databases such as Scopus, Web of Science, and Google Scholar. This has facilitated access to global research achievements in mechanics. However, the acquisition of new monographs and relevant journal literature for the library remains financially challenging.
- **Ongoing Issue:** Financial constraints continue to limit the acquisition of physical scientific materials.

2. Experimental Equipment:

- **Status:** The experimental equipment at the Center for Collective Use of Devices "Dynamic Process Analyzer" was upgraded in 2020 with a new computer (Intel Core i7 processor). This upgrade partially addresses the issue of outdated experimental equipment.
- **Ongoing Issue:** Due to limited orders for experimental research and budget constraints, further updates to experimental equipment are still needed.

3. Salaries and Support Services:

- **Status:** Low salaries for scientific and auxiliary staff continue to impact the effective organization of library, archive, metrology, and standardization services.
- **Ongoing Issue:** Financial constraints persist in adequately supporting these services.

4. Participation in Scientific Conferences:

- **Status:** Participation in domestic and international conferences has been partially facilitated through online formats. In some cases, Institute scientists have traveled abroad to attend conferences directly.
- **Ongoing Issue:** Financial support for physical participation in international conferences remains limited.

Conclusion: The Institute has made commendable efforts to address the shortcomings identified in the previous evaluation. However, due to factors beyond the Institute's control, some challenges persist. Continued efforts and further improvements are necessary to fully implement the recommendations and enhance the Institute's capabilities and operations.

13.1. Development Strategy of the Institute: Scientific Priorities and Strategic Cooperation

The development strategy of the Institute is guided by various regulatory frameworks, including national legislation and resolutions from the Presidium of the NASU. This strategy outlines the Institute's mission, vision, values, and scientific priorities for the next five years. It also emphasizes strategic cooperation with both domestic and international research institutions.

Mission: The Institute's mission is to advance fundamental scientific knowledge in mechanics and its practical applications, contribute to the training of highly qualified personnel, and support Ukraine's social and economic development through innovative research.

Vision: The Institute aims to reinforce its position as a leading research center in Ukraine in the fields of mechanics and applied mathematics.

Core Values:

- High professionalism

- Academic integrity and scientific ethics
- Creativity and team spirit
- Openness and interaction
- Responsibility and self-development
- Academic freedom and realization of creative potential
- Contribution to world science and international scientific cooperation
- Social responsibility

Strategic Scientific Priorities:

- 1. Mechanics of Composite and Inhomogeneous Media:**
 - Research on dynamics, statics, and stability of composite (nano-) materials and their structural elements.
 - Development of nonlinear theories for metal and composite shells.
 - Advancement of non-classical fracture mechanics.
 - Study of auxetic materials and mechanics of shell systems.
- 2. Mechanics of Shell Systems:**
 - Development of discrete and numerical approaches for studying the mechanical behavior of structurally inhomogeneous shells.
 - Analysis of deformation in anisotropic shell systems made from composite and functional-gradient materials.
 - Application of mechanical and mathematical modeling in dental implantation, focusing on osseointegration and stress fields.
- 3. Mechanics of Coupled Fields in Materials and Structural Elements:**
 - Study of thermoviscoplasticity in structural elements, considering stress states.
 - Analysis of thermoviscoplastic deformation in materials influenced by stress states.
 - Research on thermomechanical behavior and durability of structural elements under mechanical, temperature, and electromagnetic fields.
- 4. Fracture Mechanics and Fatigue:**
 - Development of models and criteria for long-term material degradation due to creep and fatigue under various stress conditions.
 - Creation of numerical-analytical methods for studying fatigue crack propagation in thin isotropic plates.
- 5. Dynamics and Stability of Mechanical Systems:**
 - Development of qualitative and analytical methods for analyzing dynamics and stability in complex nonlinear systems.
 - Application of the direct Lyapunov method to aerospace systems.
 - Study of diffraction processes and radiation forces in hydroelastic systems.
 - Analysis of stress states in elements with functional gradient materials under dynamic loads.

Strategic Cooperation: The Institute's strategy includes enhancing collaborations with:

- **NASU Institutes:** To foster joint research projects and leverage complementary expertise.
- **Higher Education Institutions:** For training and development of future scientists and to integrate research with educational programs.
- **Domestic and International Organizations:** To participate in and contribute to global scientific advancements, and to share resources and knowledge.

Implementation: The Institute will continue to build upon existing relationships and establish new partnerships to address current and emerging scientific challenges. The detailed strategy can be accessed on the Institute's website: [Institute of Mechanics Development Strategy](#).

This strategic approach aims to position the Institute at the forefront of mechanics research, ensuring its contributions to both national and international scientific communities.

13.2. Fundraising Strategy

At present, the most realistic opportunity to attract funds from third parties (European, other funds), which is used and will be used in the future, is the participation of employees, departments of the Institute (mainly together with scientists from European Institutes) in competitions that are announced in the public domain by various organizations and foundations.

13.3. Information Technology Strategy

The administration and staff of the Institute are committed to utilizing information technology as needed. For instance, to ensure the successful publication of articles authored by Institute researchers in leading English-language journals, we use Chat GPT and Grammarly to produce high-quality translations from Ukrainian to English.

13.4. Strategy regarding the organizational and personnel structure.

The personnel work strategy for the coming years is aimed at strengthening the departments by attracting talented young people to the divisions of the Institute. To this end, we oblige the staff who teach at the university to carry out appropriate work (providing information, giving a lecture on the activities of the Institute) among students. We also conduct agitation for university graduates who undergo pre-diploma practice in departments. Teachers of higher education Institutes, who undergo internships at the Institute, are also involved in the selection of personnel (invitation of graduates to graduate studies of the Institute).