DOI 10.1007/s10778-021-01101-6
International Applied Mechanics, Vol. 57, No. 5, September, 2021

12-VOLUME EDITION "MECHANICS OF COMPOSITES": CONSIDERABLE MILE-STONE IN THE CENTENARY HISTORY OF THE S. P. TIMOSHENKO INSTITUTE OF MECHANICS

A. N. Guz[*] and J. J. Rushchitsky[**]

New extended information on the 12-volume edition *Mechanics of Composites* is offered in English. It includes the contents of each volume and is addressed to the English-language reader. These contents consist of the author's names, titles of volumes, and short summaries for each volume. Also, for each chapter, the author's names and titles of all chapters are given. This article aims to somewhat fill in the lack of information in English about *Mechanics of Composites*.

Keywords: 12-volume edition "Mechanics of Composites"; statics, dynamics, and stability; composite materials and structural elements fabricated from them

102 years have passed since the founding of the S. P. Timoshenko Institute of Mechanics as the first institute of technical profile at the Ukrainian Academy of Sciences. Chronologically, this happened on November 30, 1918, and almost simultaneously with the founding of the Ukrainian Academy of Sciences (November 27, 1918). Over the years, the Ukrainian Academy of Sciences changed its name 5 times (Ukrainian Academy of Sciences in 1918–1921, All-Ukrainian Academy of Sciences in 1921–1936, Academy of Sciences of the UkrSSR in 1936–1991, Academy of Sciences of Ukraine in 1991–1993, National Academy of Sciences of Ukraine since 1994 and until now). The Institute of Mechanics also changed its name four times (Institute of Technical Mechanics in 1918–1929, Institute of Structural Mechanics in 1929–1959, Institute of Mechanics in 1959–1993, S. P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine since 1993 and until now). The first director and founder of the institute was the world-famous scientist-mechanician Stepan Prokopovych Tymoshenko (Timoshenko).

It is appropriate here to add a few words to the brief historical excursus presented above that in the first half of the institute's existence, the contribution of the scientists of the Institute of Mechanics to the world mechanics treasury can primarily be assessed as two diamonds in the form of the results of S. P. Timoshenko in the mechanics of materials and N. N. Bogolyubov in nonlinear mechanics.

The activities of the institute in the second half were more multi-faceted and diverse. First, in the early 60s, many talented young scientists came to the institute and the number of actively working scientists at the institute increased significantly. Second, the subject of scientific research has been essentially updated and in many new directions in the development of mechanics, the results began to close into the world high level.

One of the leading directions was the direction in which the problems of the mechanics of composite materials and structural elements made of such materials were investigated. Third, the institute's ties with the country's largest research and production associations have strengthened. In particular, the special engineering and design office, focused on the creation of structures from composite materials, was formed at the institute.

S. P. Timoshenko Institute of Mechanics of the National Academy of Sciences of Ukraine, 3 Nesterov St., Kyiv, Ukraine, 03680; e-mail: *guz@carrier.kiev.ua, **rushch@inmech.kiev.ua. Published in Prikladnaya Mekhanika, Vol. 57, No. 5, pp. 3–17, September–October 2021. Original article submitted June 3, 2021.

1063-7095/21/5705-0497 ©2021 Springer Science+Business Media, LLC

As a result, the institute has accumulated a large number of scientific results in the field of the mechanics of composite materials, structural elements, and structures made of such materials. These results should be understood and systematized from the point of view of the mechanics of composite materials in general. The first successful step in this direction and at the same time in acquainting the world scientific community with the results of the institute's scientists was the publication of a special issue of the world's leading abstract journal in mechanics *Applied Mechanics Reviews* [9].

Further, the idea was to publish a series of monographs of many volumes, each of which would reflect the results in the separate sub-areas of the mechanics of composite materials. The initiator and editor-in-chief of the publication was the first author of this article.

Two facts should be noted. Fact 1. Such a large publishing project has not been previously implemented either at the institute or in the country. Fact 2. At that time (1992), only one series of monographs published in English in 1973–1974 was known in the world scientific literature on the mechanics of composite materials: *Mechanics of Composites* in 8 volumes (editors L. J. Broutman and R. H. Krock). A quite detailed description of this series of books is represented in the references to this article as [1].

Since at that time the mechanics of composite materials developed quite rapidly, in the next 20 years many results have accumulated, requiring, first of all, systematization and popularization. Thus, the motivation for preparing a new series of monographs already existed at that time. It so happened that it was the Institute of Mechanics in Kyiv that realized the need for a new presentation of results in the field of the mechanics of composite materials.

All subsequent content of this article is devoted to this project, implemented over 11 years. It is described bibliographically as follows:

Mechanics of Composites: in 12 volumes (under the general editorship of A. N. Guz).
– Kiev: Vols. 1–4 Naukova Dumka, Vols. 5–12 "A.S.K." – 1993 – 2003.

Note at once some features of the edition *Mechanics of Composites*.

Feature 1. The authors of some chapters are leading scientists of the Institute of Mechanics, other institutes of the National Academy of Sciences of Ukraine, and universities of Ukraine, as well as the foreign scientists who at that time worked in the field of both basic and applied research of composite materials.

Feature 2. If we accept the concept that the mechanics of composite materials is divided into three groups of objects of study: materials, structural elements of materials, and structures made of materials — the edition includes approximately equally the first two groups and to a lesser extent the third group.

Feature 3. All volumes were published in Russian in the Ukrainian publishing house for 11 years (from 1993 to 2003).

Despite Feature 3, all 12 volumes of *Mechanics of Composites* are available not only to Russian-speaking scientists, as they are actually available in the United States Library of Congress.

Note here that this library was established in 1800 and is the research library with more than 38 million books and other printed materials. According to Wikipedia, its collections are universal, not limited by subject, format, or national boundary, and include research materials from all parts of the world and in more than 450 languages. The Library of Congress is one of the largest libraries in the world.

Note also that the 12-volume series *Mechanics of Composites* does not name the volumes. It is represented in The Library of Congress in the following form:

Guz', Alexandr Nikolaevich		Mekhanika kompozitov: v 12 tomakh / pod obshchei redaktsiei A.N. Guzia.	1993
Access: Jefferson or Adams Bldg General or Area Studies Reading Rms			Call number: TA418.9.C6 M435 1993

The above features confirm the general impression that the publication of *Mechanics of Composites* is not fully known to the English-speaking reader since it was published in Russian and is only formally available in the US Library of Congress in the form of books in Russian.

This article aims to somewhat fill in the lack of information in English about *Mechanics of Composites*.

To do this, the extended contents with the author's names, titles of volumes, and the short summaries for each volume are presented below. Also, for each chapter, the author's names and titles of all chapters are given.

VOLUME 1. STATICS OF MATERIALS (Volume editor V. T. Golovchan). – Kiev, Naukova Dumka, 1993. – 454 p.

SHORT SUMMARY. Volume 1 is devoted to the efficient analytical and numerical algorithms for studying the macroscopic properties of fibrous and granular composites with regular structure and stress–strain state in the phase volume. The characteristic of stress fields and dependence of macro-properties on the parameters of microstructure are analyzed for specific types of composites. The theory of edge effects in layered and fibrous composites is presented.

Part I (Chapters 1–5). Granular materials (*V. T. Golovchan*, *V. I. Kushch*).

Chapter 1. On the solution of boundary problems for homogeneous elastic medium with spherical inclusions.

Chapter 2. On the solution of boundary problems for homogeneous elastic semi-space with spherical inclusions.

Chapter 3. Doubly-periodical biharmonic vector functions and their application to solving the periodical problems of the theory of elasticity.

Chapter 4. Theory of elastic deformation of the porous and granular composite materials with regular structure.

Chapter 5. Thermomechanics of the porous and granular materials.

Part II (Chapters 6–9). Fibrous materials (*V. T. Golovchan*, *V. I. Kushch*).

Chapter 6. On the solution of boundary problems for homogeneous elastic medium with cylindrical inclusions.

Chapter 7. Thermomechanics of unidirectional fibrous composite materials.

Chapter 8. Theory of elastic deformation of fibrous composite materials with anisotropic matrix and fibers.

Chapter 9. Thermomechanics of the cross-reinforcing fibrous composite materials.

Part III (Chapters 10–12). Edge effects in composite materials.

Chapter 10. Statement and method of numerical solutions of edges effect problems (*Ju. V. Kokhanenko*).

Chapter 11. Composite materials under end face loading (*A. N. Guz*, *Ju. V. Kokhanenko*).

Chapter 12. Composite materials with discontinuities in fillers (*A. N. Guz*, *Ju. V. Kokhanenko*).

The list of literature includes 123 titles.

VOLUME 2. DYNAMICS AND STABILITY OF MATERIALS (Volume editor N. A. Shul'ga). – Kiev, Naukova Dumka, 1993. – 429 p.

SHORT SUMMARY. Volume 2 is devoted to the theory of the harmonical dynamical processes and statical stability of fibrous and layered composite materials. Mechanical models of piecewise-homogeneous medium and mathematical methods of investigations are described. The exact solutions of some problems within the framework of the three-dimensional theory are presented. A quantitative analysis is carried out for some fibrous and layered composite materials.

Part I (Chapters 1–5). Dynamics of composite materials.

Chapter 1. Dynamics of unidirectional fibrous composite materials (*A. N. Guz*, *N. A. Shul'ga*).

Chapter 2. Volume waves in layered composite materials (*N. A. Shul'ga*, *A. N. Podlipenets*).

Chapter 3. Surface and normal waves in layered composite materials (*N. A. Shul'ga*, *A. M. Podlipenets*).

Chapter 4. Surface effects in layered composite materials under forced vibrations (*N. A. Shul'ga*).

Part II (Chapters 6–9). Stability of composite materials.

Chapter 6. Internal instability of layered composite materials. (*I. Yu. Babich*, *A. N. Guz*).

Chapter 7. Surface instability of layered composite materials. (*A. N. Guz*, *V. N. Chekhov*).

Chapter 8. Internal instability of unidirectional fibrous composite materials. (*I. Yu. Babich*, *A. N. Guz*).

Chapter 9. Near-surface instability of unidirectional fibrous composite materials. (*A. N. Guz*, *Yu. N. Lapusta*).

Part III (Chapters 10 and 11). Continuum theories of the long waves in composites.

Chapter 10. Propagation of the long waves in composite materials (continuum theory of the first order) (*A. S. Kosmodamiansky*, *V. I. Storozhev*, *V. A. Shpak*).

Chapter 11. Propagation of the long waves in composite materials (continuum theory of the second order) (*J. J. Rushchitsky*).

The list of literature includes 511 titles.

VOLUME 3. STATISTICAL MECHANICS AND EFFECTIVE PROPERTIES OF MATERIALS (Volume editor L. P. Khoroshun). – Kiev, Naukova Dumka, 1993. – 390 p.

SHORT SUMMARY. Volume 3 is devoted to the theory of deformation and effective properties of layered, fibrous, and granular composite materials of stochastic structure. The principles of statistical description of a structurally inhomogeneous medium are stated. Some problems of transfer processes, wave propagation, and effective properties of composite materials with initial stresses in the components are considered.

Part I (Chapters 1–3). Foundations of the theory of composite material of stochastic structure (*L. P. Khoroshun*).

Chapter 1. Foundations of the theory of composite materials.

Chapter 2. The statistical description of composite materials.

Chapter 3. The methods of determination of effective constants.

Part II (Chapters 4-13). Effective properties of composite materials of the stochastic structure.

Chapter 4. Layered composite materials (*L. P. Khoroshun*).

Chapter 5. Granular composite materials (*L. P. Khoroshun*).

Chapter 6. Unidirectional fibrous composite materials (*L. P. Khoroshun*, *E. N. Shikula*).

Chapter 7. Discrete-fibrous composite materials (*L. P. Khoroshun*, *L. V. Nazarenko*).

Chapter 8. Composite materials with ellipsoidal inclusions (*L. P. Khoroshun*, *L. V. Nazarenko*).

Chapter 9. Fibrous composite materials of multidirectional reinforcement (*L. P. Khoroshun*, *E. N. Shikula*).

Chapter 10. Porous composite materials (*L. P. Khoroshun*, *E. N. Shikula*).

Chapter 11. Nonlinear deformation of composite materials (*L. P. Khoroshun*, *E. N. Shikula*).

Chapter 12. Transfer processes in composite materials (*L. P. Khoroshun*, *L. V. Nazarenko*).

Chapter 13. Wave propagation in composite materials (*L. P. Khoroshun*).

Part III (Chapters 14–16). Strength of composite materials of the stochastic structure.

Chapter 14. Evaluation of the strength of the composite material on basis of components fracture (*L. P. Khoroshun*).

Chapter 15. Stress concentration on the interface of the matrix and inclusions (*B. P. Maslov*).

Chapter 16. Finite strains in the composite materials (*B. P. Maslov*).

The list of literature includes 153 titles.

VOLUME 4. MECHANICS OF MATERIALS WITH CURVED STRUCTURES (Volume editors S. D. Akbarov, A. N. Guz). – Kiev, Naukova Dumka, 1995. – 320 p.

SHORT SUMMARY. Volume 4 is devoted to the mechanical aspects of layered and fibrous composite materials with curved structures. By curved structures is meant that the reinforcing layers or fibers are not straight, but have some initial curvature, bending, or distortion. This curvature may occur as a result of design or some technological processes. New results are presented as applied to the model of piecewise-homogeneous body and non-isotropic homogeneous body with averaged (effective) properties.

Part I (Chapter 1). Problems of mechanics of composite materials with curved structures (*S. D. Akbarov*, *A. N. Guz*).

Chapter 1. Curved structures in composite materials and some problems of mechanics of composite materials.

Part II (Chapter 2). Continual models of composite materials with curved structures (*S. D. Akbarov*, *A. N. Guz*).

Chapter 2. Principles and results of continuum analysis in the mechanics of composite materials with curved structures.

Part III (Chapters 3–8). Model of piecewise-homogeneous body in the mechanics of composite materials with curved structures.

Chapter 3. Stress state of layered composite materials with layers periodically curved in one direction (*S. D. Akbarov*, *A. N. Guz*).

Chapter 4. Stress state of layered composite materials with anisotropic curved layers (*S. D. Akbarov*, *S. M. Mustafaev*).

Chapter 5. Spatial problems on stress state in composite material with periodically curved layers (*S. D. Akbarov*).

Chapter 6. Stress state of layered composite materials with locally curved layers (*S. D. Akbarov*).

Chapter 7. Stress state in unidirectional fibrous composite materials with curved fibers (*S. D. Akbarov*, *A. N. Guz*).

Chapter 8. Nonlinear problems of mechanics of composite materials with curved structures (*S. D. Akbarov*, *E. A. Movsumov*).

List of literature includes 166 titles.

VOLUME 5. FAILURE MECHANICS (Volume editor A. A. Kaminsky). – Kiev, "A.S.K.", 1996. – 340 p.

SHORT SUMMARY. Volume 5 is devoted to the theoretical and experimental studies of failure of composite materials. An approach to long-time failure of composite material with cracks is proposed within the framework of the model of viscoelastic anisotropic body with averaged (effective) constants. The regularities of the precritical progress of cracks are presented. A non-traditional approach to failure of composite materials under compression is proposed within the framework of the three-dimensional linearized theory of stability of deformable bodies, and failure criteria are formulated.

Part I (Chapters 1–3). Long-time failure of composite materials with cracks.

Chapter 1. Theory of long-time failure of viscoelastic composite materials (*A. A. Kaminsky*).

Chapter 2. The study of the failure of plates with cracks in case of viscoelastic anisotropic composite materials (*A. A. Kaminsky*, *S. A. Kekukh*).

Chapter 3. Spatial problems of long-time failure of viscoelastic anisotropic composite materials with penny-shaped crack (*A. A. Kaminsky*, *S. A. Kekukh*).

Part II (Chapters 4–6). Failure mechanics of composite materials under compression.

Chapter 4. Continuum theory of failure of composite materials under compression (*A. N. Guz*).

Chapter 5. Validation of the continual theory of failure of composite materials under compression (*A. N. Guz*, *I. A. Guz*).

Chapter 6. Failure of composite materials with parallel cracks under compression along cracks (*A. N. Guz*, *V. M. Nazarenko*).

Part III (Chapters 7–9). Applied methods of investigations of composite materials failure.

Chapter 7. Deformation of layered plates with cracks (*B. L. Pelekh*, *V. A. Laz'ko*).

Chapter 8. Study of regularities of the precritical progress of cracks in thin plates made of polymeric composite materials (*A. A. Kaminsky*, *D. A. Gavrilov*).

Chapter 9. The optical method in damage mechanics of composite materials (*M. Ya. Filatov*).

The list of literature includes 235 titles.

VOLUME 6. TECHNOLOGICAL STRESSES AND STRAINS IN MATERIALS (Volume editors N. A. Shul'ga, V. T. Tomashevsky). – Kiev, "A.S.K.", 1997. – 394 p.

SHORT SUMMARY. Volume 6 is devoted to the theory of the formation of residual stresses and the creation of various shortcomings and defects. Algorithms of prediction of some defects and rational control of technological parameters of treatment of reinforced polymers are described. Methods of investigation of some problems for shells, plates, and rods are presented taking into account the residual stresses. A variant of the fracture mechanics of composite materials with cracks is considered taking into account residual stresses along cracks.

Part I (Chapters 1–6). Kinetics of formation of temperature fields, physical-mechanical properties, and stress–strain state of materials in technological processes.

Chapter 1. Composite materials, components, and typical technologies of creation of structural members (*N. A. Shul'ga*, *V. T. Tomashevsky*, *V. S. Yakovlev*, *M. P. Nosov*).

Chapter 2. Formation of stresses and strains inhomogeneous curing polymer medium (*V. T. Tomashevsky*, *V. S. Yakovlev*).

Chapter 3. Modeling of thermomechanical processes under ultrasonic welding of polymer materials (*V. G. Karnauhov*, *I. K. Senchenkov*).

Chapter 4. Formation of stresses and strains in composite materials with polymer matrix under processes of winding and warming up (*V. T. Tomashevsky*, *V. S. Yakovlev*).

Chapter 5. Mechanism of cracks creation and defects creation in composite materials at the stage of polymerization and in processes of cooling to vitrification temperature (*V. T. Tomashevsky*, *V. S. Yakovlev*).

Chapter 6. Model of formation of technological temperature stresses and mechanism of macro-defects in composite materials at the stage of cooling process to end temperature (*V. T. Tomashevsky*, *V. S. Yakovlev*).

Part II (Chapters 7–12). Influence of residual stresses, technological and structural factors on strength and stability of members made of composite materials.

Chapter 7. Mechanical models and main problems of determination of the stress–strain state of structural members made of composite materials taking into account the technological stresses (*A. N. Guz*, *N. A. Shu'ga*).

Chapter 8. Brittle fracture mechanics of composite materials with cracks taking into account initial stresses along cracks (*A. N. Guz*).

Chapter 9. Stress–strain state of orthotropic layered shells (*N. A. Shul'ga*, *A. O. Rasskazov*, *Yu. M. Fedorenko*).

Chapter 10. Stability of conical and cylindrical layered shells (*N. A. Shul'ga*, *A. O. Rasskazov*, *A. P. Primak*).

Chapter 11. Influence of technological defects on strength and stability of structural members fabricated of composite materials (*A. S. Zahvatov*, *V. T. Tomashevsky*, *V. S. Yakovlev*).

Chapter 12. Wave propagation in layered composite materials with interphase imperfects (*N. A. Shul'ga*).

The list of literature includes 167 titles.

VOLUME 7. STRESS CONCENTRATION (Volume editors A. N. Guz, A. S. Kosmodamiansky, V. P. Shevchenko). – Kiev, "A.S.K." Publ., 1998. – 387 p.

SHORT SUMMARY. Volume 7 is devoted to the presentation of the basic results on stress concentration in plates and shells made of composite materials. The main results are obtained using two-dimensional and three-dimensional statements for statical and dynamical loadings in cases of linear and nonlinear problems. Anisotropy of composite materials, decreasing shearing rigidity, and nonlinearity (in separate cases) are taken into account. The cases of holes, cracks, and local loads are considered.

Part I (Chapters 1–6). Stress concentration in anisotropic cylindrical bodies and plates.

Chapter 1. Two-dimensional stress–strain state of a multi-connected anisotropic elastic body (*S. A. Kaloerov*, *E. S. Goryanskaya*).

Chapter 2. Plane problems of the theory of elasticity for the anisotropic body (*A. S. Kosmodamiansky*, *S. A. Kaloerov*, *E. S. Goryanskaya*).

Chapter 3. Solution of two-dimensional problems of crack theory by the method of linear conjugation (*S. A. Kaloerov*).

Chapter 4. Main problems for semi-plane and strip (*S. A. Kaloerov*, *E. V. Avdjushina*).

Chapter 5. Three-dimensional statical problems for transversely isotropic plates (*E. V. Altukhov*).

Chapter 6. Stress concentration in thin orthotropic plates under vibrations and diffraction of elastic waves (*A. S. Kosmodamiansky*, *V. I. Storozhev*).

Part II (Chapters 7–9). Stress-strain state of orthotropic shells with stresses concentrators (local loads and cracks).

Chapter 7. Methods of fundamental solutions in the theory of orthotropic shells (*V. P. Shevchenko*).

Chapter 8. Study of stress–strain state of anisotropic shells of arbitrary curvatures under local loadings (*V. P. Shevchenko*).

Chapter 9. Orthotropic shells with cracks (*V. P. Shevchenko*, *E. N. Dovbnja*, *V. A. Zvang*).

Part III (Chapters 10–12). Statical problems for shells with holes.

Chapter 10. Non-thin transversely isotropic shells (*Yu. N. Nemish*, *I. Yu. Khoma*).

Chapter 11. Linear problems for shells taking into account transversal shear (*A. N. Guz*, *K. I. Shnerenko*).

Chapter 12. Nonlinear problems for shells made of composite materials (*A. N. Guz*, *I. S. Chernyshenko*, *V. A. Maksimjuk*).

The list of literature includes 235 titles.

VOLUME 8. STATICS OF STRUCTURES MEMBERS (Volume editor Ya. M. Grigorenko). – Kiev, "A.S.K." Publ., 1999. – 384 p.

SHORT SUMMARY. Volume 8 is devoted to the principles of statics of shells made of composite materials in different statements: classical, refined, and spatial ones, taking into account the anisotropy of composite materials and inhomogeneous properties along with the thickness of shells. Main problems in cases of shells of revolution, shells of noncircular cross-section, and flexible shells in linear and nonlinear statements are considered taking into account temperature fields. Contact problems for shells fabricated of composite materials are presented also. Analytical and numerical methods of investigation of the above-mentioned problems are described.

Part I (Chapters 1–3). Statical problems for thin-walled structural members made of composite materials (Ya. M. Grigorenko, A. T. Vasilenko).

Chapter 1. Main equations and relationships of the theory of layered shells.

Chapter 2. Analysis of the stress–strain state of shells of revolution made of composite materials.

Chapter 3. Analysis of shells of various forms.

Part II (Chapters 4–6). Determination of stress–strain state of shells made of composite materials based on refined theory.

Chapter 4. Main relationships of some variants of the refined model of shells (*A. T. Vasilenko*).

Chapter 5. Main relationships of stress–strain state of structural members of shell type (*A. T. Vasilenko*, *G. P. Urusova*).

Chapter 6. Analysis of the stress–strain state of various forms of shells made of composite materials (*A. T. Vasilenko*, *G. P. Urusova*).

Part III (Chapters 7–10). Analysis of the stress–strain state of structural members made of inhomogeneous materials in a spatial statement.

Chapter 7. Solution of problems for elastic non-isotropic bodies of canonical forms (*A. T. Vasilenko*, *Ya. M. Grigorenko*, *N. D. Pankratova*).

Chapter 8. Analysis of the stress–strain state of structural members fabricated of inhomogeneous anisotropic materials (*A. T. Vasilenko*, *Ya. M. Grigorenko*, *N. D. Pankratova*).

Chapter 9. Analysis of the stress–strain state of orthotropic non-circular cross-section hollow cylinders (*Ya. M. Grigorenko*, *G. G. Vlaikov*).

Chapter 10. Spatial stress–strain state of layered elastic bodies of non-canonical forms (*Yu. N. Nemish*).

Part IV (Chapter 11–13). Statical problems for flexible structural members fabricated of composite materials.

Chapter 11. Main equations of the theory of thin-walled structural members made of composite materials in a geometrically nonlinear statement (*Ya. M. Grigorenko*, *N. N. Krjukov*).

Chapter 12. Analysis of the stress–strain state of flexible shells of revolution under axisymmetrical loading (*Ya. M. Grigorenko*, *N. N. Krjukov*).

Chapter 13. Analysis of the stress–strain state of flexible structural members of complex forms (*Ya. M. Grigorenko*, *N. N. Krjukov*).

Part V (Chapter 14–17). Contact problems for thin-walled shells.

Chapter 14. Interaction of anisotropic shells and rigid bodies (*B. L. Pelekh*, *A. V. Maksimuk*).

Chapter 15. Contact problems for layered shells and plates (*B. L. Pelekh*, *A. V. Maksimuk*).

Chapter 16. Solutions of contact problems for shells of revolution interacting with elastic bodies (*A. T. Vasilenko*, *I. G. Emel'janov*).

Chapter 17. Analysis of contact interaction of cylindrical shells with elastic and rigid bodies (*A. T. Vasilenko*, *I. G. Eme'janov*).

The list of literature includes 170 titles.

VOLUME 9. DYNAMICS OF STRUCTURAL MEMBERS (Volume editor V. D. Kubenko). - Kiev, "A.S.K." Publ., 1999. - 384 p.

SHORT SUMMARY. Volume 9 is devoted to a presentation of the results of theoretical and experimental studies in the dynamics of structural members made of composite materials. Natural, forced, and parametrical vibrations of homogeneous isotropic and anisotropic shells as well as shells non-homogeneous along thickness are considered. The stationary and non-stationary processes in structural members as well as their interaction with acoustic and elastic media are investigated. The dynamical problem in linear and non-linear statements is analyzed. Mathematical methods of analysis and description of some devices for making experiments are presented.

Part I (Chapters 1–6). Small vibrations.

Chapter 1. Vibrations of anisotropic shells (*E. I. Bespalova*, *A. B. Kitajgorodsky*).

Chapter 2. Parametrical vibrations of shells of revolution made of composite materials (*A. T. Vasilenko*, *P. H. Cherin'ko*).

Chapter 3. Stationary waves in layered orthotropic ribbed cylindrical shells (*V. A. Zarutsky*).

Chapter 4. Vibrations of thick-walled anisotropic cylindrical shells (*N. A. Shul'ga*, *A. Ya. Grigorenko*, *I. L. Efimova*).

Chapter 5. Thermo-mechanical vibrations theory of viscoelastic thin-walled shells made of composite materials (*V. G. Karnaukhov*, *I. F. Kirichok*, *V. I. Kozlov*).

Chapter 6. Influence of dissipative heating on vibrations of thin-walled structural members made of composite materials (*V. G. Karnaukhov*, *I. F. Kirichok*, *V. I. Kozlov*).

Part II (Chapters 7–11). Nonlinear and non-stationary processes.

Chapter 7. Resonance vibrations of orthotropic cylindrical shells with geometrical imperfects (*V. D. Kubenko*, *P. S. Koval'chuk*).

Chapter 8. Dynamical instability of shells under axial loading (*V. D. Kubenko*, *P. S. Koval'chuk*).

Chapter 9. Nonlinear flexural waves in orthotropic shells of revolution (propagation and interaction) (*P. S. Koval'chuk*).

Chapter 10. Non-stationary aerohydroelasticity of layered shells (*A. E. Babaev*, *V. D. Kubenko*).

Chapter 11. Non-stationary aerohydroelasticity of bodies of multilayer structure (*A. E. Babaev*, *V. D. Kubenko*).

Part III (Chapters 12–14). Experimental investigations.

Chapter 12. Experimental analysis of nonlinear vibrations of shells of revolution made of glass-fiber-reinforced plastic (*V. D. Kubenko*, *P. S. Koval'chuk*, *V. D. Lakiza*).

Chapter 13. Natural and parametrical vibrations of cylindrical shells (*A. I. Telalov*).

Chapter 14. The action of plane shock on structural members (*I. I. Anik'ev*, *M. I. Mikhaylova*).

The list of literature includes 216 titles.

VOLUME 10. STABILITY OF STRUCTURAL MEMBERS (Volume editor I. Yu. Babich). – Kiev, "A.S.K." Publ., 2001. – 376 p.

SHORT SUMMARY. Volume 10 is devoted to a presentation of the results on stability theory of structural members fabricated of composite materials obtained within the framework of three-dimensional and applied two-dimensional statements. The main relationships and methods of solution are described as applied to linear and nonlinear problems, ribbed and nonribbed shells, single- and three-layered shells. The influence of geometrical and mechanical inhomogeneities and imperfections on the stability loss is analyzed. The results on the stability theory as applied to thermosensitive shells are considered. Some results on the post-critical behavior of shells fabricated of composite materials are described.

Part I (Chapters 1–6). Three-dimensional linearized stability theory of structural members made of composite materials.

Chapter 1. Properties of composite materials. Main models in the theory of stability of structural members (*I. Yu. Babich*, *A. N. Guz*).

Chapter 2. Relationships and equations of the three-dimensional linearized theory of stability of deformable bodies. Methods of solution (*I. Yu. Babich*, *A. N. Guz*).

Chapter 3. Internal instability of composite materials under different conditions on interfaces (*I. A. Guz*).

Chapter 4. Stability of plates and rods fabricated of composite materials (*I. Yu. Babich*, *A. N. Guz*).

Chapter 5. Stability of spherical and cylindrical shells fabricated of composite materials (*I. Yu. Babich*, *A. N. Guz*).

Chapter 6. Stability of layered shells and shells with fillers (*I. Yu. Babich*, *A. N. Guz*).

Part II (Chapters 7–12). Applied theories of stability of shells structural members made of composite materials.

Chapter 7. Stability of shells of revolution in case of small deflections of the original form of generatrix (*D. V. Babich*).

Chapter 8. Stability of shells taking into account the temperature dependence of elastic properties (*D. V. Babich*, *L. P. Khoroshun*).

Chapter 9. Stability of ribbed shells of revolution made of composite materials (*V. A. Zarutsky*, *I. V. Zhemchuzhnikova*, *V. S. Kashpersky*, *Yu. V. Sljusarenko*).

Chapter 10. Geometrically nonlinear theory of elastic shells made of composite materials (*N. P. Semenyuk*, *Yu. Ya. Dushek*, *N. B. Zhukova*).

Chapter 11. Stability, initial post-critical behavior, and sensitivity to imperfections of cylindrical shells made of composite materials (*N. P. Semenyuk*, *N. B. Zhukova*, *T. F. Ogil'ko*).

Chapter 12. Stability of cylindrical and conical shells made of elastoplastic reinforcing materials (*I. Yu. Babich*, *A. V. Borisejko*, *N. P. Semenyuk*).

The list of literature includes 285 titles.

VOLUME 11. COMPUTATIONAL METHODS (Volume editors Ya. M. Grigorenko, Yu. N. Shevchenko). – Kiev, "A.S.K." Publ., 2002. – 400 p.

SHORT SUMMARY. Volume 11 is devoted to a presentation of computational methods for linear and nonlinear problems of the mechanics of composites. The methods of reduction of three- and two-dimensional problems of the theory of shells to one-dimensional problems are considered, the method of discrete orthogonalization is used at the next step. Taking into account the concept of basic factors, the method of meshes is used to construct discrete models of the three-dimensional theory of elasticity and the three-dimensional theory of stability of deformable bodies as applied to the mechanics of composites. Some variants of the FEM are considered as applied to problems of the mechanics of composites under non-isothermal processes of loading.

Part I (Chapters 1–5). Methods of reduction to one-dimensional problems as applied to the theory of shells. Computational solution of one-dimensional problems.

Chapter 1. Method of spline-approximation in statical problems of plates and flexible shells made of composite materials (*Ya. M. Grigorenko*, *N. N. Krjukov*).

Chapter 2. Method of spline-approximation in statical problems of stress–strain state of shells made of composite materials within the framework of refined models of shells (*Ya. M. Grigorenko*, *N. N. Krjukov*).

Chapter 3. Computational solutions of stress–strain state problems for shells of revolution under local and contact loading (*A. T. Vasilenko*, *G. K. Sudavtsova*).

Chapter 4. Computational solutions of stress–strain state problems for anisotropic shells and plates under complex boundary conditions (*A. T. Vasilenko*, *G. P. Urusova*).

Chapter 5. Spline-approximation and Fourier series in two-dimensional nonlinear problems for elastic flexible layered orthotropic shells of revolution (*Ya. M. Grigorenko*, *A. M. Timonin*).

Part II (Chapters 6–8). Mesh method in three-dimensional statical and stability problems in the mechanics of composites.

Chapter 6. Construction of discrete models on basic factors (*Yu. V. Kokhanenko*, *V. M. Bystrov*).

Chapter 7. Computational solutions for the theory of elasticity of composite materials (*Yu. V. Kokhanenko*, *V. M. Bystrov*).

Chapter 8. Some computational solutions of three-dimensional problems of stability of composite materials and structural members (*Yu. V. Kokhanenko*, *I. A. Guz*, *V. S. Zelensky*).

Part III (Chapters 9–13). Finite-element method in the mechanics of structural members made of composite materials under non-isothermal processes of loading.

Chapter 9. Main equations (*Yu. N. Shevchenko*).

Chapter 10. Finite-element methods in non-stationary axisymmetrical problems of thermal conductivity of compound structural members made of composite materials (*Yu. N. Shevchenko*, *V. V. Piskun*).

Chapter 11. Finite-element methods in non-stationary three-dimensional problems of thermal conductivity of structural members made of composite materials (*Yu. N. Shevchenko*, *V. G. Savchenko*).

Chapter 12. Finite-element methods in axisymmetric thermoviscoplasticity problems for compound structural members made of composite materials (*Yu. N. Shevchenko*, *V. V. Piskun*).

Chapter 13. Computational solutions of spatial thermoviscoplasticity problems for structural members made of composite materials (*Yu. N. Shevchenko*, *V. G. Savchenko*).

The list of literature includes 203 titles.

VOLUME 12. APPLIED INVESTIGATIONS (Volume editors A. N. Guz, L. P. Khooshun). – Kiev, "A.S.K." Publ., 2003. – 390 p.

SHORT SUMMARY. Volume 12 is devoted to a presentation of the results of applied investigations on the mechanics of composite materials and structural members made of composite materials, design, and production technology of structural members. Experimental results on the mechanical, heat-physical, and electrodynamical characteristics of composite materials with polymeric and metallic matrix are presented. Experimental results on statics, dynamics, and stability of the radiotransparent structural members made of composite materials are described. Some problems of design and production technology of radiotransparent and load-bearing structural members made of composite materials are discussed.

Part I (Chapters 1–9). Experimental investigations of physical-mechanical characteristics of materials.

Chapter 1. Foundations of non-destructive control of composite materials with polymeric and metallic matrix (*A. N. Guz*, *A. A. Bogaychuk*, *G. G. Margolin*, *F. G. Makhort*, *M. I. Yatzenko*).

Chapter 2. Thermoelasticity of composite materials (*L. P. Khoroshun*, *B. P. Maslov*, *P. G. Shishkin*).

Chapter 3. Mechanical characteristics of unidirectional fibrous materials (*G. A. Vanin*, *A. A. Kritzuk*, *V. I. Ozerov*).

Chapter 4. Strength of polymeric composite materials under plane stress state (*G.G. Margolin*).

Chapter 5. Characteristics of composite materials under changing loadings (*I. P. Petrenko*, *M. Yu. Filatov*).

Chapter 6. Heat-physical characteristics of composite materials (*A. A. Kritzuk*, *V. N. Makarhuk*, *S. I. Matoshko*).

Chapter 7. Electrodynamical characteristics of the radiotransparent structural members made of dielectric composite materials (*Yu. I. Burikin*, *A. V. Zhuravlev*, *N. A. Shul'ga*).

Chapter 8. Effect of aggressive medium on physical-mechanical characteristics of polymeric composite materials (*V. V. Lushchik*, *S. V. Yur'ev*).

Chapter 9. Experimental-theoretical investigations of non-linear elastic and 3D reinforcement composite materials (*L. P. Khoroshun*, *E. N. Shikula*, *A. A. Kritzuk*).

Part II (Chapters 10–13). Experimental investigations of the structural members.

Chapter 10. Analysis of stability of shells of revolution made of composite materials under statical loading (*R. E. Emel'yanov*, *V. V. Konovalenko*, *V. I. Ozerov*, *K. I. Shnerenko*).

Chapter 11. Non-stationary deformation of cylindrical shells under the action of short impulse pressure in water (*I. I. Anik'ev*, *M. I. Mikhaylova*, *E. A. Suschenko*).

Chapter 12. The action of statical and impact loadings on structural members made of composite materials (*I. I. Anik'ev*, *M. I. Mikhaylova*, *E. A. Suschenko*).

Chapter 13. Analysis of bearing value of shell structural members under hydrostatic pressure (*D. V. Babich*, *A. G. Girchenko*, *I. V. Ignatov*, *I. K. Koshevoy*, *A. A. Kritzuk*, *Yu. A. Rabotnov*, *A. F. Romanchenko*, *I. G. Strel'chenko*, *S. V. Urbanskii*).

Part III (Chapters 14–16). Production technology and design methods of structural members made of composite materials.

Chapter 14. Accelerated methods of solidification of structural members made of composite materials (*V. V. Konovalenko*, *A. V. Morozov*).

Chapter 15. Production technology of multilayered structural members made of composite materials (*A. G. Girchenko*, *I. V. Ignatov*, *V. M. Khobotov*, *S. V. Yur'ev*).

Chapter 16. Design and production of load-bearing structural members (*A. G. Girhenko*, *I. V. Ignatov*, *V. I. Ozerov*, *O. V. Galuschak*).

The list of literature includes 222 titles.

Thus, the edition *Mechanics of Composites* summarizes the results of many years and diverse research of composite materials, structural elements of composite materials, and partly structures themselves carried out at the S. P. Timoshenko

Institute of Mechanics in collaboration with other scientific and research institutions since the late 1950s up to the early 21 century.

These results were obtained as applied to composite materials and structural members (shells, plates, rods, and others) fabricated of composite materials. Models of piecewise-homogeneous medium and homogeneous medium with average (effective, macro) properties were used, the methods of determining the average (effective, macro) properties for composite materials with regular and stochastic structures were developed. The statics, stability, dynamics, and fracture problems for composite materials layered, fibrous and granular structures and structures members (shells, plates, rods, and others) were considered. In the case of mechanics of composite materials, the three-dimensional theory of deformable bodies including the three-dimensional theory of stability of deformable bodies were used.

Note also that two most significant editions [2, 3] published a few years after the publication of the last volume of edition *Mechanics of Composites* complement only the results of the edition under discussion.

It should be stressed finally that two generations of the scientists of the S. P. Timoshenko Institute of Mechanics (leading scientists and their pupils) successfully worked in the area of mechanics of composite materials and created the scientific edition *Mechanics of Composites* which can be estimated as an essential contribution to the mechanics of composite materials.

As a final point, it is noteworthy that some scholars of the S. P. Timoshenko Institute of Mechanics continue the old tradition to publish generalizing scientific results in world-leading scientific publishing houses [4–8, 10–14].

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