TABLE OF CONTENTS

| From a | the F | oreword to the First Edition | 1 |
|----------------|----------|---|-----|
| Forew | ord t | o the Second Edition | 2 |
| Chap | ter | I. THEORY OF THIN-WALLED BEAM-SHELLS OF | |
| | | OPEN CROSS SECTION | 3 |
| ş | 1, | Classification of structural elements according to their | |
| | | spatial character | 3 |
| 6 | 2. | Fundamental hypotheses. Calculation models. Flexural torsion | 5 |
| ş | 3. | Displacements and strains. Law of sectorial areas. | |
| | | Generalized hypotheses for plane sections | 11 |
| 9 | 4. | The law of plane sections as a particular case of the law | |
| | - | of sectorial areas | 21 |
| S | 5. | Stress-strain relation. | 27 |
| 5 | 6. | Differential equations of equilibrium for a beam in | • - |
| - | - | arbitrary coordinates. | 33 |
| ş | 7. | | |
| | ~ | coordinates. | 40 |
| ş | 8. | Generalized cross-sectional forces. The bimoment and its | |
| _ | | physical meaning. | 47 |
| ş | 9, | The shear center | 51 |
| C b a a | . | | |
| Cusb | ter | II. CALCULATIONS FOR THIN-WALLED BEAMS OF | |
| | | OPEN CROSS SECTION | 57 |
| ş | 1. | Coordinates of the shear center and sectorial geometrical | |
| | | characteristics for certain cross sections | 57 |
| ş | 2. | Torsion of a beam subjected to a transverse load. | 75 |
| ş | 3. | Application of the method of initial parameters to the | |
| | | design of beams subject to torsion | 80 |
| ş | 4. | Beams subjected to terminal torsional moments | 92 |
| ş | 5. | | 96 |
| ş | 6. | Beam torsion and the determination of the bimoments under | |
| - | | | 109 |
| ş | 7. | Torsion of a beam subjected to longitudinal shear force | |
| • | | | 122 |
| ş | 8. | | 135 |
| ş | 9, | | 141 |
| ş | 10. | Practical method for designing hipped systems and shells | |
| • | | | 145 |
| ş | 11. | Beams and shells with cross sections having only one degree | |
| | | · · · · · | 150 |
| ş | 12, | Flexural torsion of a cylindrical shell with a long rectangular | |
| | | | 157 |
| ŝ | 13. | | 162 |
| | - | | |

| ş | 14. | Calculation of beams, allowing for longitudinal bending moments | 165 |
|------|------|--|-----|
| ş | 15. | Transverse bending moments in thin-walled beams | 171 |
| | | | |
| Chap | ter | | |
| | | TRANSVERSE CONNECTIONS | 181 |
| 5 | 1. | Method of spatial design of multiply supported structures | 181 |
| Ş | 2. | Beams reinforced by braces | 185 |
| ş | з. | Beams reinforced by closely-spaced strips and diagonal braces | 196 |
| ş | 4. | Beams reinforced by diaphragms | 203 |
| ş | 5. | Torsion of a beam embedded in an elastic medium | 209 |
| ş | 6. | Joint action of a plate and thin-walled beam reinforcing it . | 217 |
| | | | |
| Chap | oter | IV. THIN-WALLED BEAM-SHELLS OF CLOSED SECTION. | |
| | | ACCOUNT OF SHEAR DEFORMATIONS | 222 |
| ş | 1. | General variational method of reducing complex two-dimen- | |
| • | | sional problems of shell theory to one-dimensional problems | 222 |
| ş | 2. | Beam-shell with variable rectangular profile | 231 |
| ş | 3. | Design of a shell of variable rectangular section without | |
| | | allowance for shear | 244 |
| ş | 4. | Design of a beam-shell of rigid rectangular section, | |
| | | allowing for shear deformations | 249 |
| 5 | 5. | Space structures with rigid contours having a single symmetry axis | 252 |
| 5 | б. | Experimental verification | 255 |
| Ch | | | |
| Cuat | lel | V. SPATIAL STABILITY OF THIN-WALLED BEAMS LOADED AT THE ENDS BY LONGITUDINAL FORCES | |
| | | | 767 |
| | | AND MOMENTS. | 263 |
| 5 | 1. | Differential equations of beam stability | 263 |
| ş | 2, | Integration of the stability equations for the cases of hinged | |
| | | or lixed ends | 272 |
| 5 | 3, | Axial compression. Study of the roots of the characteristic | |
| | | equation, Generalization of Euler's theory. | 274 |
| ş | | Analysis of beam forms after buckling. Centers of rotation | 277 |
| ş | 5. | Design of an axially compressed beam with asymmetrical | |
| _ | | cross section | 279 |
| ş | | Stability of plane bending under eccentric compression | 281 |
| ş | | "Isostabs" of eccentric critical forces | 283 |
| ş | 8. | Stability of plane bending in beams under eccentric exten- | _ |
| - | ~ | sion. Stability circle | 284 |
| ş | | Stability of a rectangular strip. | 286 |
| ş | | Stability of a T-beam | 288 |
| ş | 11. | Stability of a compressed chord (of box-like section) of | |
| | 40 | a railway bridge | 289 |
|) | 12, | Stability of plane bending under pure bending | 290 |

| 5 | 13, | Determination of the critical forces from the end conditions | |
|------|-------|---|------------|
| | - | of the beam /68/ | 292 |
| ş | 14, | Experimental verification of the theory on structural and | |
| | | aircraft metal beams. | 299 |
| ş | 15, | Stability of beams, loaded at the ends by bimoments | 308 |
| Chap | ter | VI. GENERAL THEORY OF STABILITY OF PLANE | |
| - | | BENDING IN THIN-WALLED BEAMS AND GIRDERS . | 311 |
| ş | 1, | General differential equations of stability for plane bending . | 311 |
| ş | 2. | Stability under longitudinal forces arbitrarily distributed along | |
| | | the beam | 322 |
| ş | 3. | Stability of plane bending of thin-walled girders subjected | |
| - | | to a transverse load. General case | 325 |
| ŝ | 4. | Stability of a wide-flanged beam in plane bending. | |
| • | | Generalization of Timoshenko's problem | 326 |
| ş | 5. | Stability of plane bending of beams with zero sectorial | |
| 3 | | rigidity. Generalization of Prandtl's problem | 330 |
| ş | 6. | Application of the method of virtual displacements to the | |
| 3 | •• | spatial stability of beams | 335 |
| | | | 5.50 |
| Chap | + a = | VII. EQUILIBRIUM OF THIN-WALLED BEAMS UNDER | |
| Cush | | COMBINED LOADING. | 343 |
| | | | 343 |
| ş | 1. | Bending and torsion of beams subjected to initial stress. | 343 |
| § | 2. | Bending and torsion of a beam under longitudinal load | 347 |
| ş | 3. | Bending and torsion of beams with pretensioned reinforcement | 350 |
| ş | 4. | Torsion of beams subjected to thermal stress | 352 |
| ŝ | 5. | Stability of beams subjected to initial stresses | 354 |
| - | | | |
| Chap | ter | VIII. SPATIAL STABILITY OF THIN-WALLED BEAMS WITH | |
| | | CONTINUOUSLY DISTRIBUTED ELASTIC AND RIGID | |
| | | TRANSVERSE CONNECTIONS | 355 |
| - | | | |
| 5 | 1. | Stability of beams embedded in an elastic medium | 355 |
| ş | 2. | Stability of a beam subjected to an axial longitudinal force . | 356 |
| ş | 3. | Stability of a beam subjected to an eccentric longitudinal force | 360 |
| ş | 4. | Stability of beams rigidly fixed along a line parallel to the axis | 363 |
| ş | 5. | Application of the method of virtual displacements | 368 |
| ş | 6. | Spatial stability of arch bridges | 372 |
| ş | 7. | Spatial stability of suspension bridges | 376 |
| ş | 8. | Application of the theory to the stability design of airfoils | 379 |
| 5 | 9. | Stability of a circular cylindrical shell with reinforcing beams /54/ | 382 |
| • | | | |
| Chap | ter | IX. GENERAL THEORY OF FLEXURAL-TORSIONAL | |
| • | | VIBRATIONS AND DYNAMIC STABILITY | 386 |
| | | | |
| ş | 1. | Differential equations of free vibrations | 386 |

| ş | 2. | Integration of the equations of vibration for beams . | | • | • | 389 |
|---------|-------|---|------|------|---|-------------|
| ş | 3. | Vibration of beams under a longitudinal force | | | • | 393 |
| ş | 4. | Action of time-dependent load | | • | • | 398 |
| ş | 5. | Spatial flexural-torsional vibrations of suspension bri | dge | s. | | 403 |
| ş | 6. | Free vibrations and aerodynamic stability of airfoil-t | уре | 2 | | |
| • | | structures | · . | | | 406 |
| | | | | | | |
| Chap | ter | X. BEAMS OF SOLID SECTION | • | • | ٠ | 412 |
| ş | 1. | General theory. Fundamental equations | • | • | • | 412 |
| ş | 2. | Beams with two axes of symmetry | • | • | ٠ | 422 |
| ş | з. | Beams with a single axis of symmetry | | • | • | 424 |
| ş | 4. | Note on Saint-Venant's principle | | • | • | 430 |
| ş | 5. | Warping of a beam in extension | | | • | 431 |
| ŝ | 6. | Warping of a strut in compression and bending | | | | 434 |
| • | | | | | | |
| Chap | ter | XI. BIMOMENT THEORY OF THERMAL STRESSES | \$. | ٠ | ٠ | 439 |
| ş | 1. | Basic equations | • | • | • | 439 |
| ş | 2. | Thermal stresses in a semi-infinite beam | | • | • | 442 |
| ş | з. | Thermal stresses in a finite beam | • | • | • | 445 |
| Chap | ter | XII. PLANE AND TORTUOUS THIN-WALLED CUR BEAMS | IVE | D. | | 448 |
| ş | 1. | Bending and torsion of a plane beam whose axis form | is a | | | |
| | | circular arc of small curvature | • | | • | 448 |
| ş | 2. | Spatial stability of circular beams, arches and torus- | -she | ells | | |
| - | | of rigid section. Fundamental equations | | • | | 45 4 |
| ş | з. | Radially loaded circular ring. Particular cases. | | | | |
| • | | Generalization of Maurice Levy's problem | | | | 455 |
| ş | 4. | | f | | | |
| • | - | Timoshenko's problem | | | | 457 |
| Ş. | 5. | | ax | is. | | |
| 3 | | Generalization of another problem of Timoshenko . | | - | - | 458 |
| ş | 6. | | he l | hi- | • | |
| З | •• | moments | | | | 459 |
| | | | • | • | • | 100 |
| A SHO | ORT | HISTORICAL SKETCH AND LITERATURE SURVEY | | • | ٠ | 464 |
| BIBLIC | GR | АРНҮ | | • | • | 473 |
| List of | f Ru: | ssian abbreviations | | • | ٠ | 490 |
| | | | | | | |
| Subjec | et in | dex | | • | | 492 |
| | | | | | | |