

# Table of Contents

<b>1. Basic Theory of Elastic Stability</b> .....	1
1.1 Equilibrium Paths for Deformed Systems .....	2
1.2 Stable and Unstable Equilibrium States .....	6
1.3 Bifurcation Points, Limit Points, and Critical Loads .....	12
1.4 Energy Criterion for Bifurcational Stability Loss .....	15
1.5 Homogeneous Linearized Equations .....	23
1.6 Supercritical Behavior of Elastic Structures .....	27
1.7 Stability of Elastic Structures Under Combined Loading: Boundary of Stability Region .....	31
1.8 On the Statement of Stability Problems for Thin-Walled Structures .....	37
<b>2. Energy Method for the Solution of Stability Problems</b> .....	45
2.1 Principle of Virtual Displacements .....	45
2.2 Variational Approaches in the Linear Theory of Elasticity .....	52
2.3 Two Basic Forms of the Energy Criterion for Bifurcational Stability Loss .....	56
2.4 Energy Criterion in Bryan Form .....	60
2.5 Energy Criterion in Timoshenko Form .....	67
2.6 Rayleigh–Ritz Method in Stability Analysis .....	72
2.7 The Galerkin Method and its Relationship to the Rayleigh–Ritz Method .....	77
<b>3. Stability of Straight Columns</b> .....	85
3.1 Statement of the Problem: Basic Linearized Equation .....	85
3.2 Examples of the Analytic Solution of the Basic Equation ....	94
3.3 Columns on Elastic Foundations and Elastic Supports .....	103
3.4 Stability of Self-Gravitating Column .....	110
3.5 Lateral Torsional Beam Buckling .....	121
3.6 The Influence of Transverse Shear Strains: Stability of Sandwich Struts .....	129

3.7	Method of Initial Parameters in Stability Analysis . . . . .	135
<b>4.</b>	<b>Stability of Plates . . . . .</b>	<b>143</b>
4.1	Statement of the Problem:	
	Basic Initial Relations . . . . .	143
4.2	Basic Linearized Equation . . . . .	152
4.3	Solution of Basic Equation for a Rectangular Plate . . . . .	161
4.4	Solution of Basic Equation for a Circular Plate . . . . .	173
4.5	Approximate Solutions of the Basic Linearized Equation . . . . .	178
<b>5.</b>	<b>Energy Method for the Study of the Stability of Plates . . . . .</b>	<b>189</b>
5.1	Energy Method for the Problem of Plate Bending:	
	Accounting for Shears . . . . .	189
5.2	Application of the Energy Criterion in Bryan Form . . . . .	194
5.3	The Energy Criterion in Timoshenko Form:	
	Thermoelasticity Problem of Plate Stability . . . . .	198
5.4	Stability Criterion Statement	
	via Statically Admissible Initial Internal Forces . . . . .	203
5.5	Examples of Applications of the Energy Method:	
	Influence of Transverse Shear . . . . .	206
5.6	Stability of Plates under Local Loads . . . . .	216
<b>6.</b>	<b>Stability of Shells . . . . .</b>	<b>221</b>
6.1	Stability of Circular Ring . . . . .	221
6.2	Basic Initial Relations for a Cylindrical Shell . . . . .	239
6.3	Stability of Cylindrical Shell	
	Subjected to Axial Compression . . . . .	252
6.4	Determination of Critical Value of External Pressure . . . . .	258
6.5	Stability of Cylindrical Shell	
	Under Torsion and Transverse Bending . . . . .	266
6.6	Stability of a Shell Stiffened by Elastic Frames . . . . .	271
6.7	Determination of Critical Loads	
	Using the Stability Criterion in Timoshenko Form . . . . .	278
<b>7.</b>	<b>Nonlinear Problems: Stability of Real Bars, Plates, and Shells . . . . .</b>	<b>287</b>
7.1	Deformation of Compressed Bar After Stability Loss . . . . .	287
7.2	Supercritical Behavior of Elastic Plates . . . . .	294
7.3	Nonlinear Approaches in Stability Problems	
	for Shells . . . . .	301
7.4	Initial Imperfections in Stability Problems	
	for Bars and Plates . . . . .	308
7.5	Initial Imperfections in Stability Problems for Shells . . . . .	315

<b>A. Appendix</b> .....	321
A.1 Eigenvalue Problems .....	321
A.2 Stationary Values and Extrema of Functions and Functionals .....	324
<b>References</b> .....	331
<b>Index</b> .....	335



<http://www.springer.com/978-3-540-65700-2>

Stability of Elastic Structures

Alfutov, N.A.

2000, X, 338 p., Hardcover

ISBN: 978-3-540-65700-2