

Spatial Contact Problems in Geotechnics

Boundary-Element Method

Bearbeitet von
Sergey Aleynikov

1. Auflage 2010. Buch. xix, 648 S. Hardcover

ISBN 978 3 540 25138 5

Format (B x L): 15,5 x 23,5 cm

Gewicht: 2440 g

[Weitere Fachgebiete > Technik > Bauingenieurwesen > Boden- und Felsmechanik, Geotechnik](#)

Zu [Leseprobe](#)

schnell und portofrei erhältlich bei


DIE FACHBUCHHANDLUNG

Die Online-Fachbuchhandlung beack-shop.de ist spezialisiert auf Fachbücher, insbesondere Recht, Steuern und Wirtschaft. Im Sortiment finden Sie alle Medien (Bücher, Zeitschriften, CDs, eBooks, etc.) aller Verlage. Ergänzt wird das Programm durch Services wie Neuerscheinungsdienst oder Zusammenstellungen von Büchern zu Sonderpreisen. Der Shop führt mehr als 8 Millionen Produkte.

Contents

1	Spatial Contact Models of Elastic Bases	1
1.1	Fundamental Solutions of Static Problems of Spatial Theory of Elasticity	1
1.1.1	Concentrated Forces in an Elastic Body	1
1.1.2	Green's Displacement Tensor	2
1.1.3	Kelvin's Tensor of Influence	3
1.2	Elastic Homogeneous Isotropic Half-Space	5
1.2.1	Mindlin's Solution	5
1.2.2	Boussinesq and Cerruti Solutions	6
1.3	Coupled Half-Spaces	8
1.4	Elastic Layered Bases	12
1.4.1	Constant-Width Elastic Layer	12
1.4.2	Variable-Thickness Elastic Layer	17
1.4.3	Multilayer Elastic Half-Space	25
1.5	Elastic Bases with the Deformation Modulus, Variable with Depth	55
1.5.1	Variation of Deformation Modulus with Depth	55
1.5.2	Normal Concentrated Force Acting on the Half-Space Surface	58
1.5.3	Settlement of a Nonhomogeneous Half-Space Surface	63
	References	83
2	Static Analysis of Contact Problems for an Elastic Half-Space	91
2.1	Boundary Integral Equations of the Contact Problem for an Absolutely Rigid Punch, Deepened into an Elastic Half-Space, Under a Spatial Load System	91
2.2	Finite-Measure Analogue of the Contact Problem Using Direct Boundary-Element Method	96
2.3	Numerical-and-Analytical Method of Integration of Fundamental Mindlin's Solutions	101
2.4	Punch in the Shape of a Rotation Body, Deepened into an Elastic Half-Space	108
2.4.1	Axisymmetric Contact Problem	110
2.4.2	Torsion of an Axisymmetric Punch in an Elastic Half-Space	115

2.5	Contact Problems for Rigid Punches Located on the Elastic Base Surface	119
2.5.1	Indentation of a Punch with a Flat Smooth Base into an Elastic Half-Space	121
2.5.2	Torsion of an Elastic Half-Space by a Rigid Punch	126
	References	131
3	Computer Implementation of Boundary-Element Algorithms	135
3.1	Software for Solving Spatial Problems of Contact of Foundations with Soil Bases	136
3.2	Specific Features of Numerical Solutions of Linear Algebraic Equation Systems with Non-symmetrical Matrices, Arising in Boundary-Element Analysis	146
3.3	Effective Discretization of 2-D Domains of Complex Shape at Numerical Solving of Spatial Contact Problems of Theory of Elasticity	150
3.3.1	Algorithm of Triangulation in the Boundary-Element Method	151
3.3.2	Dual Grids and Their Application in Boundary-Element Method	162
3.4	Automated Construction of Spatial Grids of Boundary Elements on the Surfaces of Contact of Deepened Foundation Structures with Soil	174
3.5	Test Examples of Numerical Modeling of Spatial Problems of Contact Interaction	192
3.5.1	Contact Problems for Flat Punches with a Smooth Base	192
3.5.2	Contact Problems with the Account of the Deepening Factor for Axisymmetric Punches, Interacting with an Elastic Half-Space	218
	References	243
4	Contact Interaction of Shallow Foundations with Nonhomogeneous Bases	251
4.1	Spatial Contact Problems for Rigid Flat-Bottom Punches	253
4.2	Contact Problems for Rigid Rectangular Punches, Resting on Elastic Nonhomogeneous Bases	278
4.2.1	Contact Interaction at Central Loading	282
4.2.2	Contact Interaction at Off-Centre Loading with the Account of Unilateral Constraints	295
4.3	Control of the Parameters of Loading and Shape to Provide a Uniform Settlement of Rigid Foundation Plates	300
4.3.1	Formulation of the Problem and Its Numerical Implementation	301
4.3.2	External Load Control	303
4.3.3	Shape Parameter Control	307

4.4	Spatial Stress-Strained State of the Base of a Rigid Strip Variable-Width Foundation	311
4.4.1	Contact Problem for a Variable-Width Strip Foundation . .	312
4.4.2	Stress-Strained State of a Strip Foundation Base	315
4.4.3	Contact Pressure Distribution in the Area of the Strip Foundation Width Variation	317
4.5	Calculation of the Section Kernel Boundary for Rigid Foundation Plates	323
4.6	Numerical Algorithms of Solving Boundary Integral Equations in Spatial Contact Problems for a Nonlinearly Deformable Base	334
4.6.1	Spatial Contact Model for a Nonlinearly Deformable Base	335
4.6.2	System of Nonlinear Contact Equations of the Contact Problem for Absolutely Rigid Punches of a Complex Shape with a Flat Base	337
4.6.3	Iterative Processes of Solving a Finite-Measure Analogue of the Spatial Contact Problem for a Nonlinearly Deformable Base	339
4.6.4	Contact Problem for a Round Punch on a Nonlinearly Deformable Base	341
4.6.5	Estimation of Nonlinear Deformation Effects from Punch Test Results	348
4.7	Contact Problem for Orthotropic Foundation Plates with the Account of the Specific Features of Spatially Nonhomogeneous Base Deformation	351
4.7.1	Static Calculations of Foundation Plates on Elastic Bases .	352
4.7.2	System of Integro-Differential Equations of Bending of a Plate, Resting on an Elastic Base	358
4.7.3	Calculation of Rectangular Orthotropic Plates Based on Combining Finite-Difference and Boundary-Element Methods	361
4.7.4	Examples of Numerical Modelling of the Contact Interaction of Plates with Elastic Bases	364
	References	372
5	Calculation of Bases for Rigid Complex-Shaped Deepened Foundations According to the Second Limiting State in a Three-Dimensional Formulation	385
5.1	General Information on the Calculation of Bases for Foundation Structures from the Deformations	390
5.2	Spatial Problems for Calculation of Foundation Bases with the Account of the Depth Factor	396
5.3	Calculation of Bases for Pyramidal Piles Under Vertical, Horizontal, and Momental Loads	415

5.3.1	Existing Approaches to the Calculation of Piles with a Variable Cross-Section	416
5.3.2	Calculation for the Vertical Load	420
5.3.3	Calculation for the Action of a Horizontal Load	420
5.3.4	Calculation for the Action of an Inclined Load	422
5.3.5	Calculation for the Combined Action of an Inclined Force and a Moment	423
5.4	Interaction of Bases and Rigid Bored Foundations with Vertical and Inclined Piles	424
5.4.1	Structure, Design, and Specific Features of Calculation of Rigid Pile Foundations with Short Piles and a Pile Raft	425
5.4.2	Vertical Cylindrical Piles Under an Inclined Load	428
5.4.3	Foundations with Inclined Piles and a Rectangular Pile Raft	435
5.5	Spatial Contact Problem for a Bored Pile Foundation with a Widening	438
5.5.1	Production and Structures of Bored Pile Foundations with a Support Widening	439
5.5.2	Engineering Methods for Calculation of Bored Pile Foundation Bases from the Base Deformation	441
5.5.3	Calculation of Deformations of the Base of a Bored Pile Foundation with a Spheroconical Widening Under a Central Loading (Axisymmetric Contact Problem)	443
5.5.4	Calculation of Displacements and Slopes of a Bored Pile Foundation Under an Inclined Load	448
5.6	Calculation of Contact Interaction of Bases with Slotted Foundations of Industrial and Civil Buildings	454
5.6.1	Slotted Foundations of Various Structural Shapes	454
5.6.2	Calculation of Slotted Foundations Based on the Base Deformation	457
5.6.3	Contact Stress on the Lateral Surface of a Slotted Foundation	476
5.6.4	Slotted Foundations with Lateral Widenings	491
	References	493
6	Spatial Contact Problems for Porous Elastic Bases	505
6.1	Soil Mass Deformation Due to the Pore Pressure Decline	509
6.1.1	Integral Representation of Displacements in a Porous Elastic Medium	509
6.1.2	Dilatation Relations	512
6.2	Distribution of Pressure in a Layer in Case of Functioning Horizontal Wells	514
6.2.1	Distributed Sources of Predetermined Intensity	514
6.2.2	Account of the Finite Radius of the Well	516

6.3	Contact Problems for Foundation Structures at a Reduced Pore Pressure in the Soil	517
6.3.1	Integral Equations of a Spatial Contact Problem	517
6.3.2	Finite-Dimensional Algebraic Analogue of the Integral Equation System	519
6.3.3	Numerical Algorithm of Solution of the Contact Problem	520
6.3.4	Contact Problem for Shallow Foundations	522
6.4	Examples of Numerical Calculations	524
6.4.1	Spatial Deformation of the Land Surface	526
6.4.2	Surface Deformations of the Layer	532
6.4.3	Settlements and Slopes of Rigid Foundation Plates	533
	References	534
	Conclusions	537
	Appendix A Fundamental Solutions of Spatial Theory of Elasticity for a Homogeneous Isotropic Half-Space	543
	Appendix B Numerical Schemes for Surface Integral Calculations	555
	Appendix C Round Punch on an Elastic Layer of Variable Thickness at Central and Off-Centre Load	569
	Appendix D Foundation Under a Tower-Type Structure on a Wedge Base	581
	Appendix E Finite-Difference Equations of Cylindrical Bend of Orthotropic Slabs Located on an Elastic Foundation	591
	Appendix F Calculation of the Base for a Pyramidal Pile Under Vertical Load According to the “Instructions Manual for Design of Foundations Made of Pyramidal Piles”	603
	Appendix G Isolines of Contact Stress on a Lateral Surface of a Slotted Foundation	613
	Appendix H Numeric Schemes of Volume Integration	629
	Index	637