

Table of Contents

Chapter 1. Introduction	1
1.1. Historical background.	1
1.2. Considering the plastic and rheological properties of materials in calculating and designing resistance structures for constructions	3
1.3. The basis of the mathematical model for calculating resistance structures by taking into account the rheological properties of the materials	4
Chapter 2. The Rheological Behavior of Building Materials	9
2.1. Preamble	9
2.2. Structural steel for construction	19
2.2.1. Structural steel for metal construction.	19
2.2.2. Reinforcing steel (non-prestressed)	22
2.2.3. Reinforcements, steel wire and steel wire products for prestressed concrete	23
2.3. Concrete.	32
Chapter 3. Composite Resistance Structures with Elements Built from Materials Having Different Rheological Properties	45
3.1. Mathematical model for calculating the behavior of composite resistance structures: introduction	45
3.2. Mathematical model for calculating the behavior of composite resistance structures. The formulation considering creep.	49
3.2.1. The effects of the long-term actions and loads: overview	49
3.2.1.1. Composite structures with discrete collaboration	61
3.2.1.2. Composite structures with continuous collaboration	67
3.2.1.3. Composite structures with complex composition	80
3.2.2. The effect of repeated short-term variable load actions: overview	86

3.3. Mathematical model for calculating the behavior of composite resistance structures. The formulation considering stress relaxation.	95
3.3.1. The effect of long-term actions and loads: overview	95
3.3.1.1. Composite structures with discrete collaboration	102
3.3.1.2. Composite structures with continuous collaboration	106
3.3.1.3. Composite structures with complex composition	115
3.3.2. The effect of repeated short-term variable actions and loads: overview	120
3.4. Conceptual aspects of the mathematical model of resistance structure behavior according to the rheological properties of the materials from which they are made	125
Chapter 4. Applications on Resistance Structures for Constructions	129
4.1. Correction matrix	129
4.1.1. The displacement matrix of the end of a perfectly rigid body due to unit displacements successively applied to the other end of a rigid body	130
4.1.2. The reaction matrix of the end of a perfectly rigid body due to unit forces successively applied to the other end of a rigid body.	132
4.2. Calculation of the composite resistance structures. Formulation according to the creep	133
4.2.1. Preliminaries necessary to systematize the calculation of composite structures in the formulation according to the creep	133
4.2.2. Composite structures with discrete collaboration	136
4.2.3. Composite structures with continuous collaboration	140
4.2.4. Composite structures with complex composition	155
4.3. The calculation of composite resistance structures. Formulation according to the stress relaxation	161
4.3.1. Preliminaries necessary to systematize the calculation of the composite structures in the formulation according to the stress relaxation	161
4.3.2. Composite structures with discrete collaboration	165
4.3.3. Composite structures with continuous collaboration	172
4.3.4. Composite structures with complex composition	179
Chapter 5. Numerical Application	189
5.1. Considerations concerning the validation of the mathematical model proposed for estimation through calculation of the behavior of the resistance structures by considering the rheological properties of the materials	189
5.2. The RALUCA computer applications system.	191
5.3. The resistance structure.	198
5.4. Numerical experiments	203

5.4.1. The first series of experiments	203
5.4.1.1. The particular conditions for the analysis of the mathematical model	204
5.4.2. The second series of experiments	206
5.4.2.1. The particular conditions for the analysis of the mathematical model	206
5.4.3. The third series of experiments	211
5.4.3.1. The influence of the parameters defining the creep function . . .	211
5.4.3.2. The stresses state in the structure caused by the contraction of the concrete	214
5.4.3.3. The influence of the deformability of the connection elements on the effort's distribution among the elements of the structure	217
Appendix 1. The Initial Stresses and Strains State of the Structures with Continuous Collaboration	223
A.1. Simply supported beam with uniformly distributed load	227
A.2. Simply supported beam loaded with a concentrated force	230
A.3. Simply supported beam loaded with a concentrated moment at each end	233
A.4. Simply supported beam loaded with concentrated forces applied eccentrically, acting on a direction parallel with the axis of the beam	235
Appendix 2. Systems of Integral and Integro-differential Equations	241
1. Integro-differential equations whose unknown factors are functions of one variable.	242
2. Integro-differential equations whose unknown factors are functions of two variables	251
3. Integro-differential equations whose unknown factors are functions of one or two variables.	260
Bibliography	283
Index	287