

Contents

1	Introduction	1
1.1	Background and Significance	1
1.2	Review	3
1.2.1	Shaking Table Test Technology	3
1.2.2	Dynamic Characteristics of Slope	5
1.2.3	Deformation Characteristics and Instability Mechanism	8
1.2.4	Seismic Stability Evaluation Method	9
1.2.5	Prediction Model for Earthquake-Induced Landslide Hazard	13
1.3	Problems	14
1.4	Research Objectives and Content	15
2	Seismic Array Monitoring Results Analysis	19
2.1	General Condition	19
2.2	Monitoring Data of Seismic Array in 5.12 Wenchuan Earthquake	21
2.3	Response Characteristics Analysis	22
2.4	Frequency Spectrum Response Characteristics	25
2.4.1	Fourier Spectrum Along Elevation	25
2.4.2	Seismic Ground Motion Response Spectrum Along Elevation	28
2.5	Brief Summary	30
3	Shaking Table Test of Rock Slopes	31
3.1	Large-Scale Shaking Table Test Design	32
3.1.1	Purpose	32
3.1.2	Installation	32
3.1.3	Similarity System	32
3.1.4	Similar Materials	38
3.1.5	Test Instruments and Monitoring Points Disposition Principle	40

3.1.6	Testing Points Disposition	43
3.1.7	Design and Manufacture	46
3.1.8	Sensors	51
3.1.9	Loading Scheme	53
3.1.10	Data Collecting System	57
3.1.11	Result Record	57
3.2	Result Analysis	60
3.2.1	Influence Factors of Acceleration Amplification Effect	61
3.2.2	Fourier Spectrum and Response Spectrum of Acceleration	81
3.3	Brief Summary	88
4	Numerical Analysis Research	91
4.1	Brief Introduction to GDEM	91
4.1.1	Advantages of GDEM Software	92
4.1.2	Fundamental Principle of GDEM	93
4.1.3	Verification	94
4.1.4	Fundamental Function	97
4.1.5	Modeling Progress and Methods	98
4.2	Key Problems in Numerical Analysis	98
4.2.1	Numerical Analysis Model	99
4.2.2	Material Parameters and Constitutive Model	101
4.2.3	Boundary Conditions	101
4.2.4	Seismic Ground Motion Input Conditions	102
4.3	Verification of Numerical Analysis Results	104
4.4	Seismic Dynamic Response Features	105
4.4.1	Acceleration Amplification Effects	105
4.4.2	Acceleration Fourier Spectrum	107
4.4.3	Acceleration Amplification Effects	110
4.5	Local Topography Effect	111
4.5.1	Key Problems in Numerical Analysis	112
4.5.2	Calculation Results Analysis	114
4.6	Brief Summary	118
5	Theoretical Solutions of Acceleration Amplification of Hill	121
5.1	Formula Derivation	121
5.1.1	General Thinking and Basic Assumption	122
5.1.2	Generalized Analysis Model	122
5.1.3	Derivation Process	123
5.1.4	Time–Frequency Analysis Process	128
5.1.5	Practical Application	128
5.2	Solving Approach	130
5.3	Verification	130
5.3.1	Overview	130
5.3.2	Verification	131

- 5.4 Parameter Analysis 133
 - 5.4.1 Peak Value 133
 - 5.4.2 Frequency 133
 - 5.4.3 Bevel Angles. 135
 - 5.4.4 “Whiplash Effect” 136
- 5.5 Comparative Analysis. 137
 - 5.5.1 Brief Introduction of Some Seismic Design Code. 137
 - 5.5.2 Code for Seismic Design of Buildings
GB50011-2010 138
 - 5.5.3 Specifications for Seismic Design of Hydraulic
Structures DL/5073-2000. 138
 - 5.5.4 Design Specification for Slope of Hydropower
and Water Conservancy Project SL/386-2007 139
 - 5.5.5 Comparative Analysis 139
- 5.6 Brief Summary 141
- 6 Slope Deformation Characteristics and Formation Mechanism 143**
 - 6.1 Brief Introduction 144
 - 6.1.1 Numerical Simulation Method. 145
 - 6.1.2 Numerical Analysis Model 145
 - 6.1.3 Numerical Constitutive Model and Material
Parameters. 145
 - 6.1.4 Boundary Conditions. 147
 - 6.2 Deformation Characteristics and Disaster Mechanism. 147
 - 6.2.1 Whole Landslide Process. 147
 - 6.2.2 Landslide Hazard Phenomenon 149
 - 6.2.3 Landslide Mechanism Analysis 151
 - 6.3 Brief Summary 161
- 7 Slope Seismic Stability 163**
 - 7.1 Slope Seismic Stability. 164
 - 7.1.1 General Thinking and Basic Assumption. 164
 - 7.1.2 Generalized Analysis Model 165
 - 7.1.3 Reflective and Transmission Coefficients. 166
 - 7.1.4 Instant Seismic Stability Coefficient 169
 - 7.1.5 Time–Frequency Analysis Process of Seismic Waves 171
 - 7.1.6 Practical Application of Seismic Wave
Time–Frequency Effects 171
 - 7.2 Time–Frequency Analysis Formula Derivation. 174
 - 7.3 Verification. 174
 - 7.3.1 Overview. 175
 - 7.3.2 Gravitational Stress Field. 176
 - 7.3.3 Calculation Results’ Comparison. 176

7.4	Study on Parameters	179
7.4.1	Incident Angle on Transmitted and Reflected Coefficients of the Structural Surface	180
7.4.2	The Influence of Elasticity Modulus of Cover Layer on Transmitted and Reflected Coefficients of the Structural Surface	182
7.4.3	The Influence of Incident Angle on Transmitted and Reflected Coefficients of the Structural Surface	183
7.4.4	The Influence of Elasticity Modulus of Cover Layer on Transmitted and Reflected Coefficients of the Structural Surface	185
7.4.5	The Influence of Elasticity Modulus of Cover Layer on Total Transmitted and Reflected Energy Coefficients of the Structural Surface	187
7.5	Advantage	188
7.6	Brief Summary	191
8	Prediction Model	193
8.1	Field Investigation	194
8.2	Controlling Factors	195
8.3	Analysis of Controlling Factors	195
8.3.1	Correlation Between Landslide Volume V and Horizontal Sliding Distance L and Vertical Sliding Distance H	196
8.3.2	Correlation Between Bevel Angle $\tan\theta$ and Equivalent Friction Coefficient f	196
8.3.3	Seismic Ground Motion Attenuation Model Based on Measured Data of Wenchuan Earthquake	197
8.3.4	Correlation Between PGA and Horizontal Sliding Distance	199
8.4	Prediction Model O	200
8.5	Case Analysis of Donghekou Landslide and Magongwoqian Landslide	202
8.6	Parameters	204
8.7	Brief Summary	205
	Conclusions and Prospects	207
	Bibliography	215



<http://www.springer.com/978-981-10-2379-8>

Slope Earthquake Stability

Changwei, Y.; Jingyu, Z.; Jing, L.; Wenying, Y.; Jianjing, Z.
2017, X, 218 p. 255 illus., 219 illus. in color., Hardcover
ISBN: 978-981-10-2379-8