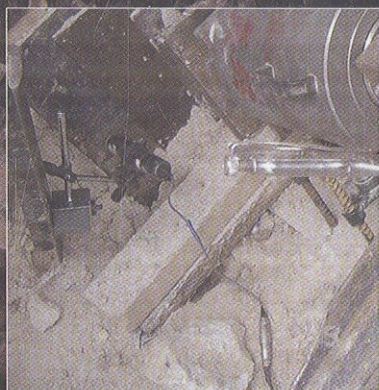
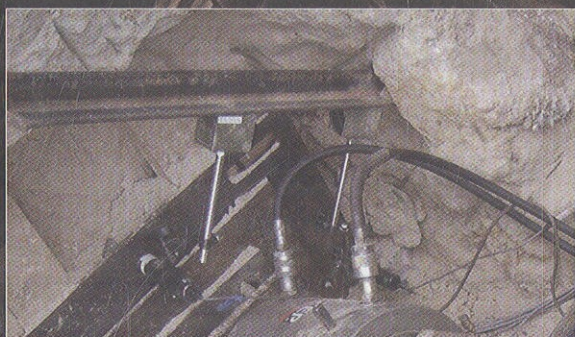


SLOPE STABILITY ANALYSIS AND STABILIZATION

New Methods and Insight



Y.M. Cheng and **C.K. Lau**

Contents

<i>List of tables</i>	ix
<i>List of figures</i>	xi
<i>Preface</i>	xvii
1 Introduction	1
1.1 Introduction	1
1.2 Background	1
1.3 Closed-form solutions	3
1.4 Engineering judgement	4
1.5 Ground model	4
1.6 The status quo	5
1.7 Ground investigation	7
1.8 Design parameters	8
1.9 Groundwater regime	8
1.10 Design methodology	9
1.11 Case histories	9
2 Slope stability analysis methods	15
2.1 Introduction	15
2.2 Slope stability analysis – limit equilibrium method	17
2.3 Miscellaneous consideration on slope stability analysis	36
2.4 Limit analysis	46
2.5 Rigid element	51
2.6 Design figures and tables	62
2.7 Method based on the variational principle or extremum principle	67
2.8 Upper and lower bounds to the factor of safety and $f(x)$ by the lower bound method	71

2.9	<i>Finite element method</i>	74
2.10	<i>Distinct element method</i>	78
3	Location of critical failure surface, convergence and other problems	81
3.1	<i>Difficulties in locating the critical failure surface</i>	81
3.2	<i>Generation of the trial failure surface</i>	85
3.3	<i>Global optimization methods</i>	90
3.4	<i>Verification of the global minimization algorithm</i>	104
3.5	<i>Presence of a Dirac function</i>	107
3.6	<i>Numerical studies of the efficiency and effectiveness of various optimization algorithms</i>	109
3.7	<i>Sensitivity of the global optimization parameters on the performance of the global optimization method</i>	117
3.8	<i>Convexity of critical failure surface</i>	120
3.9	<i>Lateral earth pressure determination</i>	121
3.10	<i>Convergence</i>	124
3.11	<i>Importance of the methods of analysis</i>	136
4	Discussions on limit equilibrium and finite element methods for slope stability analysis	138
4.1	<i>Comparisons of the SRM and LEM</i>	138
4.2	<i>Stability analysis for a simple and homogeneous soil slope using the LEM and SRM</i>	139
4.3	<i>Stability analysis of a slope with a soft band</i>	144
4.4	<i>Local minimum in the LEM</i>	148
4.5	<i>Discussion and conclusion</i>	151
5	Three-dimensional slope stability analysis	155
5.1	<i>Limitations of the classical limit equilibrium methods – sliding direction and transverse load</i>	155
5.2	<i>New formulation for 3D slope stability analysis – Bishop, Janbu simplified and Morgenstern–Price by Cheng</i>	158
5.3	<i>3D limit analysis</i>	185
5.4	<i>Location of the general critical non-spherical 3D failure surface</i>	188
5.5	<i>Case studies in 3D limit equilibrium global optimization analysis</i>	196
5.6	<i>Effect of curvature on the FOS</i>	204

6	Site implementation of some new stabilization measures	206
6.1	<i>Introduction</i>	206
6.2	<i>The FRP nail</i>	208
6.3	<i>Drainage</i>	213
6.4	<i>Construction difficulties</i>	213
	<i>Appendix</i>	214
	<i>References</i>	225
	<i>Index</i>	238