

PROCEEDINGS OF THE INTERNATIONAL WORKSHOP ON CONSTITUTIVE EQUATIONS
FOR GRANULAR NON-COHESIVE SOILS / CLEVELAND / 22-24 JULY 1987

Constitutive Equations for Granular Non-Cohesive Soils

Edited by

A.SAADA & G.BIANCHINI

Case Western Reserve University, Cleveland



A.A.BALKEMA / ROTTERDAM / BROOKFIELD / 1989

Contents

Preface	IX
1. <i>Introduction</i>	
General organization of the workshop and of the proceedings	3
<i>A.Saada & G.Bianchini</i>	
2. <i>On constitutive modelling</i>	
A brief revue of constitutive models	7
<i>A.Saada</i>	
Different classes of constitutive equations and their characteristics	11
<i>F.Darve, H.Dendani & B.Chau</i>	
Simplified hypotheses on mechanical properties equally applicable to sands and clays	19
<i>J.Biares & P.Y.Hicher</i>	
3. <i>Experiments</i>	
The development of a data base using the Case hollow cylinder apparatus	33
<i>A.Saada & P.Puccini</i>	
On effects of sample height in hollow cylinder tests	41
<i>M.Kharchafi</i>	
Development of a data base using the Grenoble true triaxial apparatus	47
<i>J.Lanier & Z.Zitouni</i>	
Kinematics with or without rotation and stress rate	59
<i>J.Lanier</i>	
4. <i>Questionnaire, information package and test results</i>	
Response to the questionnaire	63
<i>G.Bianchini & P.Puccini</i>	
Information package	81
<i>A.Saada, P.Puccini & G.Bianchini</i>	

5. Models and predictions

A cyclic elasto-plastic constitutive model for sand <i>K.Akai, T.Adachi & F.Oka</i>	101
CAP model for fitting the stress-strain response of Hostun and Reid Bedford sands <i>George Y.Baladi</i>	115
Prediction of deformation of Hostun and Reid Bedford sands with a simple bounding surface plasticity model <i>J.P.Bardet</i>	131
A constitutive model for granular materials based on two plasticity mechanisms <i>B.Cambou & K.Jafari</i>	149
Model of sand behavior towards shearing and compression in three dimensional conditions of stress and strain <i>S.Chaffois & J.Monnet</i>	169
Micromechanical approach to constitutive modelling for granular soils based on slip mechanism <i>C.S.Chang</i>	183
Use of hypoelasticity to model the behavior of sands <i>Steve A.Collins & Robert C.Bachus</i>	201
An incrementally non-linear constitutive relation and its predictions <i>F.Darve & H.Dendani</i>	237
Non linear incremental constitutive equation: Application to sands <i>T.Doanh, H.Di Benedetto, Y.Golcheh & M.Kharchafi</i>	255
Modelling the stress/strain behavior of sand using a multi-surface kinematic model <i>D.V.Griffiths & J.H.Prevost</i>	275
Prediction of deformation behaviors of sands by the subloading surface model <i>K.Hashiguchi, M.Ueno & T.Imamura</i>	293
A constitutive model for sands and its application to monotonic and cyclic loadings <i>A.Jarzębowski & Z.Mróz</i>	307
Elasto-plastic model for sand based on fuzzy-sets <i>M.Klisinski, M.M.Alawi, S.Sture, H.-Y.Ko & D.M.Wood</i>	325
Generalized hypoelastic constitutive equation <i>D.Kolymbas</i>	349
Double hardening constitutive model for soils, parameter determination and predictions for two sands <i>Poul V.Lade</i>	367
A joint-invariant bounding surface plasticity model for anisotropic behavior of sands <i>Robert Y.Liang, M.Sobhanie & H.L.Shaw</i>	383

A constitutive model of sands directly expressed in general coordinates for evaluating principal stress rotation and the comparison of its predicted values with the measured values <i>H.Matsuoka & Y.Suzuki</i>	403
An elastic-plastic two-surface model for non-cohesive soils <i>W.O.McCarron & W.F.Chen</i>	427
Elastoplastic characterization of granular media <i>M.C.McVay, F.C.Townsend & D.Bloomquist</i>	447
A multi-directional sliding model of soil deformation <i>K.Miura & W.D.Liam Finn</i>	465
A multi-surface model for non-cohesive soils <i>E.Mizuno & W.F.Chen</i>	481
'Sinfonietta classica': An exercise on classical soil modelling <i>Roberto Nova</i>	501
Transitional yielding model for non-cohesive soils <i>Yii-Wen Pan & Sunirmal Banerjee</i>	521
Generalized plasticity model for three-dimensional sand behaviour <i>M.Pastor, O.C.Zienkiewicz & A.H.C.Chan</i>	535
Internal variable model for frictional materials <i>John F.Peters</i>	551
Rate-independent constitutive descriptions for granular media <i>S.Pietruszczak & J.Jiang</i>	571
A simplified bounding surface plasticity model for predictions of sand behavior <i>A.F.Saleeb & K.A.Lou</i>	593
Adaptation of a simple cap model <i>I.S.Sandler & D.Rubin</i>	615
Verification of a constitutive model for granular materials <i>S.K.Saxena, R.K.Reddy & A.Sengupta</i>	629
Prediction number 32 <i>I.M.Smith, D.A.Shuttle, M.A.Hicks & F.Molenkamp</i>	647
Calibration, simulation and prediction of sand behavior using the bounding surface hypoplasticity model <i>Zhi-Liang Wang, Y.F.Dafalias & C.K.Shen</i>	665
 6. Panel discussions	
Evaluation and challenges to the panel <i>Raymond N.Yong</i>	685
Evaluation of constitutive models in soil mechanics <i>W.F.Chen</i>	687

Comments on the modelling of the behavior of sand <i>D.C.Drucker</i>	695
Theoretical assessments on basic structures of elastoplastic constitutive models (Panel report: International Workshop on Constitutive Equations for Granular Non-Cohesive Soils, Cleveland, 1987) <i>K.Hashiguchi</i>	699
Some effects of microstructure on the overall behaviour of granular materials <i>B.Loret</i>	717
On proper selection of identification and verification tests <i>Zenon Mróz</i>	721
Constitutive relations for soil: Present and future <i>Ronald F.Scott</i>	723
Closure <i>A.Saada & G.Bianchini</i>	727
List of participants	729