List and affiliations of authors:

Authors in the required order:

Gerd Gudehus; University of Karlsruhe, Karlsruhe, Germany
Angelo Amorosi; Technical University of Bari, Bari, Italy
Antonio Gens; Technical University of Catalonia, Barcelona, Spain
Ivo Herle; Technical University Dresden, Dresden, Germany
Dimitrios Kolymbas; University of Innsbruck, Innsbruck, Austria
David Mašín; Charles University, Prague, Czech Republic
David Muir Wood; University of Bristol, Bristol, United Kingdom
Andrzej Niemunis; University of Karlsruhe, Karlsruhe, Germany
Roberto Nova; Politecnico di Milano, Milano, Italy
Manuel Pastor; Universidad Politécnica de Madrid, Madrid, Spain
Claudio Tamagnini; Università degli Studi di Perugia, Perugia, Italy
Gioacchino Viggiani; Laboratoire 3S, UJF-INPG-CNRS, Grenoble, France.

Corresponding author:

David Mašín, Institute of Hydrogeology, Engineering Geology and Applied Geophysics, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic. E-mail: masin@natur.cuni.cz

The soilmodels.info project

The mechanical behaviour of geomaterials is complex and, as a consequence, material models form an important part of any numerical analysis in geotechnical engineering. There are so many constitutive models already available that an external observer might well question whether further constitutive models should be developed or, rather, existing models should somehow be compared and evaluated. There is no consensus within the geotechnical engineering community in addressing this question. Practising engineers are at the mercy of the model developers as they try to discover which model might be suitable for which purpose. The developers themselves are rarely impartial in their evaluation: they will typically extol the virtues of their own modelling framework while at the same time recommending further enhancement.

However, there is, in our opinion, a logical way to respond to the question. The evaluation of constitutive models should be in the hands of researchers and practitioners who wish to make use of the models for solving practical problems; leaving the developers to respond to their objective conclusions and use them for further improvement of the models. Unfortunately, the current state of constitutive modelling does not permit this line of thinking to be followed. Users of constitutive models generally have neither the time nor the expertise to implement the models into finite element codes by themselves and therefore their choice of models remains confined to the few (often primitive) models which happen to be already available in commercial FE codes or, perhaps, they may have access only to particular models which are being developed at their own research institutions.

The way to escape from this predicament is to generate a freely available database of constitutive models, which enables any researcher or potential user to choose the models that appear suitable for solving the problem with which they are confronted and to compare the capabilities of these models without having to expend any effort in their implementation. A suitable format for the implementation of the models appears to be the *umat* format of the finite element program *Abaqus*^{TM} *(Abaqus, Inc.)*. This format is already used by many researchers, it is well documented, and it is now being accepted by several other finite element codes. Equally, a simple interface function may be programmed so the *umat* can be used by other finite element programs which support user-defined models but do not presently accept the *umat* format itself.

The *soilmodels.info* web page contains links to the web-pages of individual authors, which are organised into the following main sections:

- Link to the single element program written by A. Niemunis that allows the simulation of virtually any laboratory experiment with any constitutive model that has been implemented as a *umat*. The program can be used by the constitutive model users for calibration of material constants and by developers for testing their *umat* implementations.
- Links to the implementation of constitutive models in *umat* format. It consists of the link, name of the contributor, and references to publications where the model formulation and calibration procedure are described in detail. Accuracy of the *umat* implementation is the responsibility of the contributor (i.e., no check of the *umat*s is made by the database organisers), and no liability can be accepted if a particular *umat* contains an error.
- Links to interface implementations that allow the use of *umat* formats with other finite element codes.

We propose the model developers standardize the implementation by accepting the *umat* interface. Capabilities of different models can then be easily compared using the above mentioned freeware code for element tests, while taking advantage of having acces to various models through the *soilmodels.info* repository. Finally, after publication, the model should be supplied to the database so that it can be tested in an objective and independent manner by the geotechnical community.

The authors of the database would like to encourage the developers of constitutive models to contribute to the database and to encourage the users of constitutive models both to use the database for solving their problems and to share their experiences in the use of different models.

Signed:

G. Gudehus, A. Amorosi, A. Gens, I. Herle, D. Kolymbas, D. Mašín, D. Muir Wood, R. Nova, A. Niemunis, M. Pastor, C. Tamagnini, G. Viggiani