

## **Separation of Time Scales in the HCA Model for Sand**

Andrzej NIEMUNIS and Torsten WICHTMANN

Institute of Soil Mechanics and Rock Mechanics,  
Karlsruhe Institute of Technology, Karlsruhe, Germany;  
e-mail: [andrzej.niemunis@kit.edu](mailto:andrzej.niemunis@kit.edu)

### **A b s t r a c t**

Separation of time scales is used in a high cycle accumulation (HCA) model for sand. An important difficulty of the model is the limited applicability of the Miner's rule to multiaxial cyclic loadings applied simultaneously or in a combination with monotonic loading. Another problem is the lack of simplified objective HCA formulas for geotechnical settlement problems. Possible solutions of these problems are discussed.

**Key words:** high cycle model, accumulation, time scale separation, constitutive modelling, sand.