



Aalborg Universitet

**AALBORG UNIVERSITY**  
DENMARK

## Modelling of Landslides with the Material-Point Method

Andersen, Søren Mikkil; Andersen, Lars

*Published in:*  
28th Nordic Geological Winter Meeting

*Publication date:*  
2008

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

*Citation for published version (APA):*  
Andersen, S. M., & Andersen, L. (2008). Modelling of Landslides with the Material-Point Method. In N. A. Wahl (Ed.), *28th Nordic Geological Winter Meeting: January 7 -10, 2008, Aalborg, Denmark : Abstract Volume* (pp. 85). Department of Civil Engineering, Aalborg University.

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

### Take down policy

If you believe that this document breaches copyright please contact us at [vbn@aub.aau.dk](mailto:vbn@aub.aau.dk) providing details, and we will remove access to the work immediately and investigate your claim.

## **Modelling of Landslides with the Material-Point Method**

**S. M. ANDERSEN, L. ANDERSEN**

*Department of Civil Engineering, Aalborg University, Aalborg, Denmark, (sa@civil.aau.dk),*

As a part of the globalisation, cities are built in mountainous areas in which landslides are common occurrences. If landslides cannot be prevented it is of interest to know the extent of an eventual slide. Landslides are a very complicated and varied physical phenomena depending among other factors on the slope geometry, the soil properties and the environment. Previous research has focused on determining the reliability of slopes and the risk of failure. The idea in the present paper is, however, to examine the dynamic evolution of slides in unstable slopes by means of numerical simulations.

The modelling of landslides is performed with the aid of the Material-Point Method (MPM) which has been developed in the 1990s [1,2]. In the MPM two material descriptions are employed. The soil is described using a Lagrangian description in which the soil is divided into a number of discrete points at which the mass, stresses, strains and other properties are evaluated. However, the kinematic equations are solved on an Eulerian grid, which allows the modelling of complex material behaviour and large displacements of the soil.

Different types of slope failure leading to landslides are modelled. The initial stress distribution in the slopes are determined using a finite-difference scheme. The first test case is a landslide triggered by removing part of the slope. The extent of the slide are determined for different types of soil. The second example is a landslide triggered by the cohesion being removed. This is a typical scenario after heavy rainfall in fine-grained soils. The purpose of the analysis is to provide a further understanding of the dynamical evolution of landslides in different soil-types.

### **References**

- [1] Schreyer, H.L., Suslky, D., Chen, Z., 1994. A particle method for history-dependent materials. *Computer Methods in Applied Mechanics and Engineering* 118, 179-196.
- [2] Schreyer, H.L., Suslky, D., Chen, Z., 1995. Application of a particle-in-cell method to solid mechanics. *Computer Physics Communications* 87, 236-252.