FRACTURE AND FRAGMENTATION WITH DEM

FERENC KUN[*] AND FALK K. WITTEL[†]

*Department of Theoretical Physics, Doctoral School of Physics, Faculty of Science and Technology, University of Debrecen, P.O.Box: 400, H-4002, Debrecen, Hungary, ferenc.kun@science.unideb.hu

† Institute for Building Materials, ETH Zurich, Leopold-Ruzicka-Weg 5, CH-8093, Zurich, Switzerland, fwittel@ethz.ch

ABSTRACT

Discrete element modeling (DEM) is one of the most efficient computational approaches for modeling fracture processes in heterogeneous materials at the mesoscopic scale. Since it is based on a physical discretization, DEM can account for most of the relevant mesoscopic details of materials, making the approach indispensable when experiments provide only a limited insight into the failure process. From the dynamics of single-crack propagation to the statistics of crack ensembles, and from the rapid fragmentation of materials, DEM has made a substantial contribution to our understanding over the past decades. Recently, the combination of DEM with other simulation techniques, such as Finite Element Modeling, has further expanded the field of applicability. Due to its flexibility, DEM has gained widespread applications in materials physics, engineering, and geology, playing a crucial role in materials design, the study of natural catastrophes such as landslides and snow and stone avalanches, and the modeling of industrial processes.

This session serves as a platform to discuss recent developments in discrete element models and their applications to the fracture and fragmentation of materials, with a focus on dynamical, collaborative processes that lead to failure. Topics include but are not limited to: development of novel computational tools in the DEM framework; stability, fracture, and fragmentation of materials in industrial applications and geological processes; granular breakage, continuous and dynamic fragmentation, catastrophic failure, and data-driven approaches to these problems.