Vibration propagation in discrete element particle models of rock

R. Resende
ISCTE-IUL/ADETTI-IUL, Lisbon, Portugal

E. Fortunato
National Laboratory for Civil Engineering, Lisbon, Portugal

C. Andrade
Faculty of Engineering of the Porto University, Porto, Portugal

T. Miranda
ISISE, Department of Civil Engineering, University of Minho, Guimarães, Portugal

ABSTRACT: Vibrations in rock masses can be a significant hazard, leading to human discomfort and structural damage. Recent cases of subway or tunnel excavation near existing dams in Portugal have raised again the importance of this topic. Traditional statistical tools have been used to study wave propagation in rock, but fall short when rock fracturing or faulting radically changes the way vibration propagates. Numerical models such as finite-element or finite-difference models also have some insufficiencies, namely in the way discontinuities are represented. We propose the utilization of bonded particle models based on the Particle Discrete Element Method. Synthetic rock samples are generated and their static elastic properties are calibrated by manipulating micro-properties (assembly organization and normal and shear contact stiffness). The static and dynamic properties of the rock cores are tested and the complete elastic response of the model is evaluated and discussed.