

Discrete element model of additive manufacturing with cement-based materials

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The aim of the paper is the simulation of cement-based materials by the discrete element method (DEM) and its application to 3D printing, also known as additive manufacturing. DEM is a way of simulating discrete matter and it captures the dual nature of granular media which behaves both like a solid and a fluid.

DEM is a very useful tool for the study of the mechanical properties of granular materials, such as compressive strength or wear. Numerical modelling of granular materials can be used to study the microscopic behavior of rocks and similar materials (such as concretes, ceramic materials and different composite materials). These materials can be simulated as particles with an interaction of bonding between them.

Previous work of the research group has employed discrete element methodology to study the wear behavior of concrete. The numerical analysis will allow us to carry out a study of innovative multilayer components of cement-based materials. The flexural behavior of multilayer components will be simulated (Figure 1). These components are the object of the multidisciplinary research project in which additive manufacturing of structural components using cement-based materials is studied.

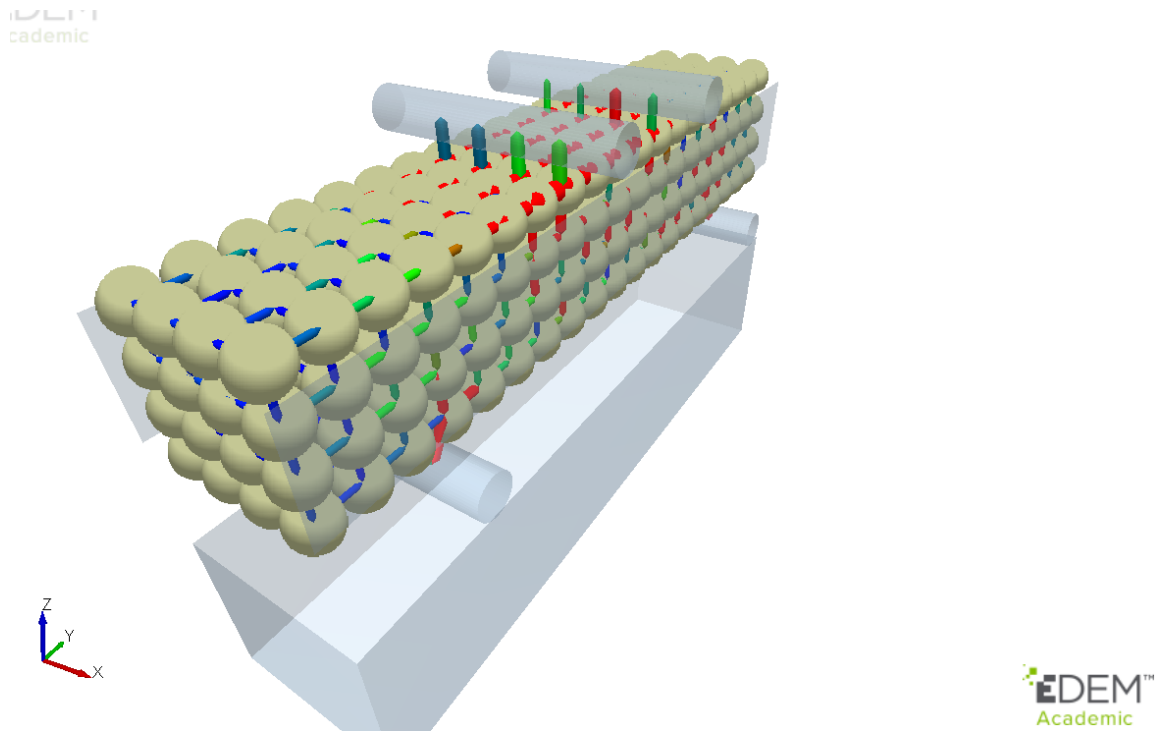


Figure 1. Discrete element model

Keywords: cement-based materials; discrete element model; additive manufacturing;