Discontinuous Medium Mechanics and Engineering Applications

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Abstract

Building materials such as cement, concrete and rock have the discontinuous nature from micro-, meso- to macro-scales. The discontinuities in this materials affect significantly the mechanical behaviors especially in dynamic loading conditions. This paper summarizes the recently development on discontinuous deformation analysis, including modified smoothed particle hydrodynamics for the analysis of heterogeneous materials, numerical manifold method in analyzing the stability of fractured rock masses, equivalent medium method for the analysis of stress wave propagation in jointed rock mass, pipe network based seepage analysis in double porosity medium, and advanced key block analysis and support design for rock masses. A newly developed explicit version of the numerical manifold method is also introduced. It demonstrated that the discontinuous medium mechanics and computational methods were distinctive. A few strategies are presented in order to improve the computational efficiency in simulating highly fractured medium. Engineering applications such as rock slope stability, rock tunnel stability, rock support design and seepage control are also introduced.

Keywords: Discontinuous Medium, Numerical Manifold Method, Computational Efficiency, Stress wave propagation, Smoothed Particle Hydrodynamics.