EXTENDED HYBRID 3D LBM FOR FLOW DRIVEN CRACK PROBLEM UNDER MULTIPLE COUPLED FIELD IN HIGHLY MACRO-POROUS MATERIALS

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This study introduces an extended 3D Lattice Boltzmann method (LBM) model for predicting effective the coupled extended electro-magneto-thermo-viscoelastic behavior of the 3D flow driven crack problem in highly macro-porous materials. First, the physical model was reconstructed by using the slices which were scan from the high resolution X-ray CT facility and the relatively LBM model was established through digitized technology. Then, the extended hybrid Lattice Boltzmann method (HLBM) proposed by the author is defined by combined with the coupled extended wave time-domain hypersingular integral equation method and the extended 3D LBM. Based on this method, the coupled extended electro-magneto-thermo-viscoelastic equilibrium distributions are derived from closed-form solutions. Third, the behavior of the general extended singular stress indices around the fluid driven crack network front terminating is analyzed by hybrid time-domain main-part analysis. The general extended singular pore stress (ESPSs), the extended dynamic stress intensity factors (EDSIFs), the extended diffusion coefficients (EDCs) and the extended diffusion velocities (EDVs) under different conditions on the fluid driven crack network surface are given. Last, the numerical method for the problem is proposed in parallel calculation environment, the EDSIFs are calculated, the results are presented toward demonstrating the applicability of the proposed method, and these can be utilized to help understand the ground water flow mechanism in Biscayne aquifer.

Flow driven crack network propagation mechanism; Lattice Boltzmann Method; Hypersingular integral equation method; Stress intensity factor; Diffusion coefficient; Biscayne aquifer