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A Coupled Hygro-Thermo-Mechanical Bond-Based Cosserat Peridynamic Porous Media Model for Heated Fracture of Concrete

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ABSTRACT

This paper presents a fully coupled hygro-thermo-mechanical bond-based Cosserat peridynamic porous media model for concrete at high temperature [1-3]. The model enables the problem of Poisson's ratio limitation to be relieved and the effect of cement particle size and its independent micro-rotation to be taken into account [4]. A multi-rate explicit integration strategy is proposed, which allows this complex multi-field fully coupled governing equation to be well solved. Numerical simulations mainly focus on the terms of temperature, water vapour pressure and damage level to verify the validity of the model [5-9]. And they additionally demonstrate the effect of cement particle size and importance of value of critical fracture energy on mechanical properties and crack propagation of heated concrete. Numerical results show the model has a good performance in modeling heated fracture of concrete at high temperature.

KEYWORDS

Bond-based Cosserat peridynamics; multi-physics; hygro-thermal behaviors; fracture of heated concrete

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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