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P2.179 Numerical investigation of mechanical and thermal characteristics of binary-sized pebble bed using discrete element method

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The characteristic identification of the functional material is important in the performance prediction of a breeding blanket, which is one of the main components of the fusion power plant. The functional material of the solid type ceramic breeding blanket is mainly used in the form of a pebble bed, which is an aggregate group of pebbles. Various experimental methods such as laser flash, hot wire, and hot disk method have been studied to assess thermal properties of the pebble bed. In recent years, numerical techniques have been also introduced to evaluate mechanical characteristics as well as thermal characteristics of pebble beds.
In this study, the mechanical and thermal behaviors of the binary-sized pebbles in the cuboidal container under cyclic loadings are simulated considering the contact interaction of the pebbles by means of discrete element method. Through a series of numerical simulations, we investigate the effects of the size discrepancy of the binary-sized pebbles on the packing and mechanical properties of the pebble bed. The stress or contact force concentration of the pebbles is also discussed, which may lead to pebble failure. Furthermore, heat conduction between the pebbles is considered based on the packing configurations obtained from the mechanical analysis, and the thermal properties of the pebble bed are qualitatively evaluated in terms of the effective thermal conductivity of the pebble bed.

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