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Numerical Validation of Heat Conduction in 2D Binary Granular Mixtures under Mechanical Loading

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Abstract. The present work aims to perform numerical simulations of heat conduction to validate existing experimental results of two-dimensional binary granular mixtures subjected to a mechanical loading. Molecular dynamics (MD) method was employed for this purpose. Three different configurations of the granular composite samples were systematically prepared under the similar experimental conditions. A confined mechanical loading was then applied to the granular samples. The fields of temperature change of each particle were plotted for each sample. The results were then statistically analyzed. Under a static equilibrium, it was found that simulation results are in good correlation with the experiments in terms of statistical analysis through the distributions of the temperature change. The temperature changes which are greater than the average temperature distributes as an exponential decreasing for all tested samples, which is consistent with the well-known force distribution law. In addition, less than 50% of particle numbers having the temperature changes which are greater than the average value is discovered. It is clearly observed that localizations of the temperature were found for each sample.

Keywords: Granular materials, Heat conduction, Mixtures, Discrete element method (DEM), Mechanical loading