Cross-correlation between 2D and 3D DEM simulation of particle mixing in the rotating drum

Wencong Wu, Kaicheng Chen, Evangelos Tsotsas, Otto von Guericke University Magdeburg, Magdeburg, Germany

Michael Jacob, Glatt Ingenieurtechnik GmbH, Weimar, Germany

Discrete Element Method (DEM) is a powerful tool in simulation regarding particle collision. But as a computationally intensive method, DEM is hard to simulate an industrial scale system with a massive number of particles. In order to predict the particle mixing behavior in industrial-scale mixers, a new approach has been proposed, which aims to find out the relevance between the mixing systems of different scales. In this study, different sizes of the horizontal rotating drums were simulated through 2D and 3D DEM, respectively. Here, the subdomain-based mixing index (SMI) was applied for quantifying the mixedness of multicomponent mixtures for all simulations. The obtained SMI were also compared and discussed with another two common-used mixing indices. Later, on the basis of the simulation results, the SMI of steady mixing state was correlated with the influential operation parameters: e.g., the revolution frequency (n) of the drum. In the end, the correlations between SMI and the influential operation parameters from 2D and 3D DEM simulations were connected, and moreover, the reliability as well as the applicability of this developed cross-correlation were evaluated.

Keywords: DEM, rotating drum, 2D, 3D, mixedness, cross-correlation