DEM Modelling of normal impact of wet particles

Ling Zhang and Chuan-Yu Wu
Department of Chemical and Process Engineering,
University of Surrey, Guildford, UK

Abstract

The presence of liquids in particulate materials can have a significant effect on their bulk behaviour during processing and handling. It is well recognised that the bulk behaviour of particulate materials is dominated by the interactions between particles. Therefore, a thorough understanding of particle-particle interaction with the presence of liquids is scientifically important to unravel complex mechanics and physics of particulate materials. In the current study, a discrete element methods for wet particulate systems was developed, in which a contact model for particle-particle interactions with pendular liquid bridges was implemented. Using the developed DEM, normal elastic impact of wet particles with a wall was systematically analysed. It was shown that the DEM simulations can accurately reproduce the experimental observations reported in the literature. In addition, the DEM analysis was also in excellent agreement with the elastohydrodynamic model. It was demonstrated that the rebound behaviour of wet particles are dominated by the Stokes number. There was a critical Stokes number, below which the particle will stick with the wall. For impacts with a stokes number higher than the critical stokes number, the coefficient of restitution increases as the stokes number increases. It was also find that the contact angle and surface tension played an insignificant role in the normal impact of wet particles, while the volume of the liquid presented has a significant effect on the rebound behaviour in addition to the Stokes number: the larger the liquid volume, the lower the coefficient of restitution. This implies that more energy is dissipated when the volume of liquid present is increased.