# Microdynamic Analysis of Particle Flow in Rotating Drums Based on Discrete Element Method and Data-Driven Approach

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## Abstract

Rotating drums are widely employed in the industrial processes involving granular materials, such as manufacturing, pharmaceuticals, food production, and chemical engineering. Understanding the behaviour of particle flow in rotating drums are important for optimising these processes, but it often presents significant challenges. In this work, the discrete element method was used to simulate the particle flow in a rotating drum under different operating conditions. Flow properties, including impact energy, angle of repose and granular temperature, were analysed in detail. The results showed that all the flow properties were affected by the operating conditions such as drum size, particle size, particle-particle sliding friction and drum rotating speed. Furthermore, a data driven machine learning framework was proposed to predict the flow properties for different operating conditions. Exploratory data analysis revealed a nonlinear correlation between each operating condition and each flow property, with the prediction accuracy exceeding 90%. The method described in this work is also capable of predicting flow properties of large-scale rotating drums based on those of small-scale drums.

## Keywords

Discrete element method, rotating drum, impact energy, machine learning.