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3D Simulation of Surface Generation in Grinding

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Abstract

A lot of computer simulations of surface generation in grinding have been performed in order to predict process performance such as ground surface roughness and material removal rate. Most of simulations apply Monte Carlo method and the non-stationary, stochastic geometry of individual abrasive grains, and their random spacial location on the grinding wheel are taken into account. The ground surface is calculated assuming that the cutting edges remove all material that they encounter with on their path. However, a lot of researches have pointed out that the elastic deflection of the wheel-workpiece contact zone which is caused by elastic behavior of both the grinding wheel and the workpiece affects the quality of the ground surface, and the magnitude of deflection is observed to be of similar order of the grain depth of cut. In this study, the cutting phenomenon with a single grain was faithfully modeled as much as possible by taking static and kinematic characteristics which have been investigated by the authors. The developed simulation makes it possible to visualize the kinematic interaction and the chip removal process between the grain and the workpiece using three-dimensional computer graphics. The topography of ground surface can be observed visually as well. The simulation can also be utilized for the prediction of the finished quality such as surface roughness and the optimization of the grinding parameters including wheel characteristics.