MATERIAL REMOVAL PHASES IN SINGLE ABRASIVE GRAIN GRINDING

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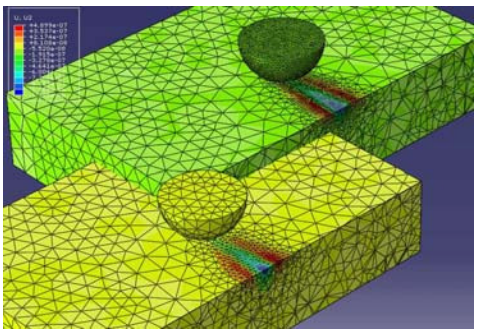
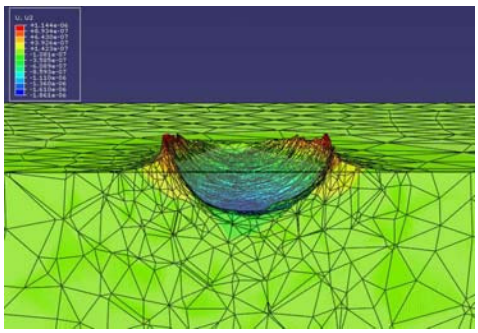
In this research basic material removal characteristics with single abrasive grain is explored by using Finite Element Analysis (FEA). Material properties of Cubic Boron Nitride (CBN) and Steel are used for abrasive grain and workpiece part in FEA simulation, respectively. ABAQUS/CAE is used as a computational environment. Transition between material removal phases are observed. Different indention depths and different size grain with a defined sliding path are simulated to investigate the effect of depth of cut in transition of material removal generally called as rubbing, ploughing and cutting phenomenon. Friction coefficient is also involved to the model by using penalty friction formulation in Abaqus. The most important thing to get good results from simulation is the satisfaction of meshing size with plastic deformation. To provide good contact conformity between two surfaces without using computational resource excessively, a remeshing strategy is built up in contact area where the high plastic deformation subjected to work material. The FEA simulation is highly strong tool to predict the grinding outcomes and results physically. The paper presents the results of rubbing and ploughing phase of grinding as shown in Figure 1. In the literature this type of model was named as micro-scale model dealing with individual grain interaction with workpiece [1, 2]. Micro-scale modelling of grinding still requires many developments for fully understanding of grinding material removal. The grinding action of a single grain including rubbing, ploughing and cutting phases was first put forth by Hahn [3] and was called as a prevailing rubbing hypothesis. Recent investigation on three dimensional finite element model of rubbing and ploughing phases in single-grain grinding has performed by Doman et al [4] by considering the elastoplastic material characteristics.



a) Comparison of remeshing size



b) Ploughing phenomenon and initiation of chip formation

Figure 1 Example of (a) remeshed part and (b) single grain scratch groove

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