Modeling the Effect of Tool Edge Preparation by ALE Method

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Abstract

The successful implementation of high speed machining for hardened steels is difficult due to their extreme hot hardness and poor thermal conductivity. The development of high temperatures and stresses results in excessive tool wear and undesirable surface characteristics. FE simulations are capable of optimizing the cutting conditions and tool geometry by predicting stresses and temperature distributions. This study aims to investigate the effect of edge preparation in the orthogonal high speed turning of hardened steel. A two dimensional FE model for the high speed turning operations when orthogonally machining AISI H13 tool steel at 49HRC using PCBN is described. An ALE method has been adopted which does not need any chip separation criteria as opposed to the traditional Lagrangian approach. Two models are simulated; one with chamfered and other with honed tool. The results show that high cutting force and lower temperatures are obtained with the chamfered tool due to greater tool-workpiece contact area as compared to the honed tool.