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(https://stm.bookpi.org/TIER-V3/issue/view/673) Modelling Orthogonal Metal Machining Using Finite Element Analysis

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Abstract

This paper discusses results of a study of simulation modelling of orthogonal metal machining with finite element method using AdvantEdge^{TM} modelling software. The AdvantEdge^{TM} is a

validated CAE software solution for the optimization of metal cutting, enabling users to analyze machining processes in 2D and 3D environments. The cutting process and mainly cutting forces were simulated from the initial state to steady-state, by incrementally advancing the cutting tool, while a geometrical chip-separation criterion, based on a critical distance at the tool tip criterion was implemented in the AdvantEdge^{TM} engine. The objective of the study was to simulate the cutting process by applying finite element method to predict the cutting forces, Chip formation and temperature at the tool-chip interface. A series of finite element simulations were performed in which friction was modelled and executed along the tool-chip interface. A finite element nodal procedure was adopted in simulating chip separation from the workpiece. The results of these simulations were consistent with experimental observations. Specifically, it was found out that tool-tip zone undergoes the largest plastic strain rate deformation during machining. It was realised that maximum temperature rises which was a product of energy dissipation due to plasticity and friction was observed to have occurred along the chip-tool interface.

Keywords: FEA; Chip-tool-interface; coefficient; forces; lagrangian-formulation; nodes; simulation; metal; machining; AdvantEdgeTM

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