

Finite Element Simulation of Turning Process and Subsequent Route for Optimization

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Abstract

In ultra-precision metal machining, the flow stress model performs well in distinguishing the ploughing effect from the phenomenon of chip separation. The distinction of material deformation (in ploughing) and lamella formation (in chip separation) is dictated by the relative tool sharpness (RTS), which is defined by the ratio of undeformed chip thickness (depth of cut) to cutting tool edge radius. This paper displays the 'flow stress phenomenon' by dint of finite element (FE) analysis in metal cutting operation using Simulia Abaqus Computer-Aided Engineering (CAE) software. The orthogonal turning process model of Al 6082 workpiece for producing continuous and discontinuous chips has been developed. The workpiece deformation was examined using the Johnson-Cook damage model and the input boundary conditions (BC) in Abaqus CAE were provided for simulating the intended operation in order to compare the FE data with previously experimented results. The overall simulation process conformed to the physical experimentations with some variations due to software restrictions. The inferences of this research have been discussed with the possibility of applying intelligent techniques that can improve the machining process.

Keywords

Flow stress, Machining, FE Simulation, Optimization, Chip Formation

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