Tool wear geometry updating in Inconel 718 turning simulations

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Abstract

In machining of nickel based superalloys, such as Inconel 718, tool wear is a major problem due to the high stresses and the high temperatures at the tool chip interface. Enhanced knowledge of the tool wear mechanism and capability to predict tool wear are therefore of great importance in machining of nickel based superalloys. The objective with this paper is to investigate if the finite element method (FEM) can be used to predict the flank and crater wear of uncoated cemented carbide tool in turning of Inconel 718. An empirical model has been implemented in a commercial FE-code and the tool geometry is continuously updated to capture the evolution of wear. Experiments have been conducted to obtain parameters for the empirical wear model and for validation of the simulations. The worn geometry at the flank and rake face as well as the cutting edge radius was measured with white light interferometry. Wear model parameters were calibrated by fitting a simulation against measured worn geometries at the flank and rake face. Then separate simulations at other cutting speeds were compared with corresponding experiments to validate the model performance.