High Precision Estimation on Physical Behavior for Cutting with Various Tool Rake Angle by Finite Element Method

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Conference paper

First Online: 28 April 2018

Part of the Lecture Notes in Mechanical Engineering book series (LNME)

Abstract

In metal cutting process, cutting force holds significant information of the cutting tool performance and material machinability. However, it still remains unclear regarding to the relationship between cutting forces and other cutting parameters, such as cutting speed and contact friction coefficient. The main objective of this paper is to design a feasible Finite Element model to estimate cutting behavior with high accuracy. Several FEM models are designed reflecting the process of orthogonal cutting. In the meantime, actual orthogonal cutting tests of mild steel AISI 1045 with TiCN-coated cermet tool are executed in order to observe the real life behavior. There are two significant phenomena can be observed from the simulation: chip thickness and contact length. It is proven that, combination of chip thickness and contact length plays major role in estimating cutting behavior with high accuracy.

Keywords

Orthogonal cutting | Finite element method | Chip thickness | Contact length