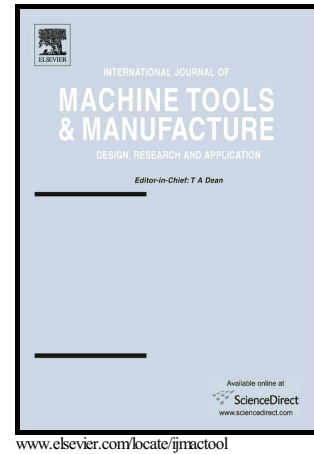


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Keywords

Machining, Carbon fiber, Composite, Elastic foundation beam, Micro-Macro-mechanical model

ABSTRACT

The present paper studies the material removal mechanism of machining carbon fiber reinforced polymer (CFRP) by a micro-mechanical model, and proposes prediction models of cutting forces from the microscale to the macroscale. At the microscale, the micro-mechanical model for cutting a fiber in orthogonal cutting CFRP is established via the elastic foundation beam theory with explicit description of the carbon fiber and the matrix. The deflection and failure of the fiber constrained by the surrounding composite are analysed under the cutting effects by the tool edge. In addition, the fiber failure under the pressing of the flank face is analysed based on the undulating fiber theory. Analytical expressions are established at the microscale for evaluating the force for cutting a single fiber and the compression force for a single fiber from the flank face. At the macroscale, the chip length is determined by analyzing the characteristics of the cutting force signals

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