



航空学报 » 2006, Vol. 27 » Issue (3) :531-535 DOI:

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高速切削有限元模拟技术研究

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Finite Element Simulation of High-Speed Cutting

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摘要

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摘要 有限元模拟是研究高速切削机理的有效方法,本文致力于有限元模拟所必需的关键技术研究。依据大变形理论和虚功原理对高速切削过程进行分析,建立了基于拉格朗日描述的有限元控制方程。通过研究材料动态本构关系、刀屑接触、切屑分离、切屑断裂和切削热动态耗散与传导关键技术建立了正交切削有限元模型,提出材料本构关系建立方法和切屑断裂能量解释观点,最后结合实例进行高速切削模拟,并对模拟结果进行分析和验证,指出所建立的有限元模型是合理的。

关键词: 高速切削 有限元模型 正交切削模拟 材料本构关系 切屑断裂

Abstract: Finite element simulation is an effective method to study high-speed cutting mechanism, and several key finite element techniques are studied in this paper. Large deformation theory and virtual work principle are applied to high-speed process, then the finite element governing equation is approached based on Lagrangian description. Orthogonal cutting finite element model is established through studying the material constitutive relation, contact of tool with chip, chip separation, chip fracture, heat dissipation and conduction key techniques. A method to construct material constitutive relation and a point of view from energy to explain chip fracture are adopted. In the end, a high-speed cutting case is simulated and the finite element model is proved to be reasonable by analyzing and validating some results of simulation.

Keywords: high speed cutting finite element model orthogonal cutting simulation material constitutive relation chip fracture

Received 2004-11-24; published 2006-06-25

引用本文:

杨勇;柯映林;董辉跃. 高速切削有限元模拟技术研究[J]. 航空学报, 2006, 27(3): 531-535.

YANG Yong; KE Ying-lin; DONG Hui-yue. Finite Element Simulation of High-Speed Cutting[J]. Acta Aeronautica et Astronautica Sinica, 2006, 27(3): 531-535.

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