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薄壁件加工变形主动补偿方法

陈蔚芳, 楼佩煌, 陈华

南京航空航天大学 机电学院

Active Compensation Methods of Machining Deformation of Thin-walled Parts

Chen Weifang, Lou Peihuang, Chen Hua

College of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics

摘要

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摘要 研究薄壁件加工过程中受力变形产生的回弹误差控制, 提出了分层完全补偿和优化补偿两种加工路径补偿方法, 建立了加工路径补偿优化模型, 考虑了多次走刀间加工变形和切削力的耦合作用, 并应用迭代算法求解路径补偿优化模型。以航空薄壁件单刃端铣加工为例, 对完全补偿、分层完全补偿和优化补偿进行了仿真分析和试验分析。结果表明, 分层完全补偿和优化补偿能更好地减少加工误差, 为薄壁件受力变形控制提供了参考依据。

关键词: 加工 变形 迭代算法 薄壁件 优化 主动补偿

Abstract: In order to control the machining error caused by cutting deformation of thin walled parts, two approaches of machining path compensation are proposed, i.e., multilayer full compensation and optimization compensation. A mathematical model is established for the optimization compensation by considering the coupling effect between the machining deformation and the cutting force. The model is solved with an iterative algorithm. The case of the end milling for a thin walled aircraft part is taken as an example to study the three compensation methods of full compensation at the last layer, multilayer full compensation, and optimization compensation. The simulation results of the three compensation methods are compared with those of experiments. The conclusion is that the last two compensation methods can reduce machining errors better than the first one. These two compensation methods are proved to be efficient in controlling machining deformation and reducing machining errors.

Keywords: machining deformation iterative algorithm thin-walled part optimization active compensation

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Corresponding Authors: 陈蔚芳

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