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航空铝合金铣削加工中切削力的数值模拟研究

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Numerical Simulation Study on Milling Force for Aerospace Aluminum Alloy

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摘要 为了弥补当前斜角切削数值模拟多采用直线刀刃的不足,结合立铣加工的实际情况,提出了适合立铣加工的螺旋齿单刃斜角切削有限元模型,进而对航空铝合金7050-T7451进行了铣削加工切削力的数值模拟研究,得到了切削力值。通过铣削力实验测得了同样切削条件下的铣削力值,数值模拟结果与实验值比较吻合,从而证明所建立的有限元模型是正确的,可用于预报铣削力值。铣削加工切削力的数值模拟研究为航空铝合金切削加工的工艺参数优化、刀具的合理选择及其优化设计奠定了基础,同时也为进一步有效控制整体结构件的加工变形提供了新的研究手段。

关键词: 铝合金 螺旋齿立铣 单刃斜角切削 数值模拟

Abstract: A finite element model based on helix primary cutting edge is presented due to current oblique cutting numerical simulation's shortcomings, in which the tool edge is straight. Then, milling process of aerospace aluminum alloy-7050-T7451 was simulated based on the presented oblique cutting model, and cutting force under the given cutting conditions is gained. A milling force experiment is carried out, and a good agreement between simulation and experimental data is achieved, which proves that the finite element model presented in this paper is correct, and milling force can be predicted by using the model. The study will be a base for process parameter optimization, tool's optimization selection and design of aluminum alloy milling process, and also a new way to control machining distortion of monolithic components.

Keywords: aluminum alloy helix end milling single edge oblique cutting numerical simulation

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