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论文

基于GA和FEM的夹具布局和变夹紧力优化设计

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摘要:

通过夹具布局和夹紧力大小的优化可以提高薄壁件加工精度. 建立了夹具布局和变夹紧力分层优化模型. 首先, 以工件加工变形最小化和变形最均匀化为目标函数, 对夹具布局进行优化设计; 其次, 基于优化的夹具布局对变夹紧力进行设计. 采用有限元法计算工件的加工变形, 加工变形求解时综合考虑了接触力、摩擦力、切削力、夹紧力和切屑的影响. 采用遗传算法求解优化模型, 获得优化的夹具布局和变夹紧力. 通过实例分析, 验证了分层优化设计方法可以进一步减小工件加工变形, 提高加工变形均匀度.

关键词: 夹具布局; 遗传算法; 有限元; 变夹紧力; 优化

OPTIMIZATION OF FIXTURE LAYOUT AND DYNAMIC CLAMPING FORCE BASED ON GENETIC ALGORITHM AND FINITE ELEMENT METHOD

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Abstract:

In order to improve the machining accuracy of a thin-walled workpiece, the fixture layout and clamping forces should be optimized for the machining operation. A dual optimization model of fixture layout and dynamic clamping forces has been established. Fir stly, an optimal fixture layout is enerated by considering the deformation degree and distribution. Thereafter, dynamic clamping forces are optimized based on the optimal fixture layout. The finite element method is used to analyze the workpiece machining deformation. A genetic algorithm is developed to solve the optimization model to obtain the optimal fixture layout and dynamic clamping forces. Finally, an example is used to illustrate that the optimization method can reduce the machining deformation effectively and improve the distribution condition.

Keywords: fixture layout; genetic algorithm; finite element; dynamic clamping forces; optimization

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