微细铣削表面粗糙度预测与试验 Experiment and Prediction Model for Surface Roughness in Micro-milling

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关键词： 微细铣削 表面粗糙度 正交回归分析 预测模型 响应曲面法

摘　要： 分别采用正交试验回归分析法和基于正交旋转组合设计的二次响应曲面法（RSM）建立了微细铣削表面粗糙度预测模型，并在微小型车铣中心上对硬铝合金进行了试验研究，分析了铣削参数对表面粗糙度的影响。分别对两种预测模型进行了显著性检验并进行对比分析后发现：二阶响应曲面法的预测精度明显优于正交回归分析法。根据二次响应曲面法的试验结果，对回归方程中的回归系数进行了显著性检验，得出了铣削参数影响表面粗糙度的线性效应、二次效应和交互效应的显著性并进行了排序。试验结果表明：在试验采用的工艺参数范围内，对微细铣削表面粗糙度影响重要程度依次是铣削速度、每齿进给量、切削深度。An orthogonal experiment regression analysis and a response surface methodology are used to build the models to predict roughness of aluminum surface machined by a micro turn-milling NC machine. The influence of milling parameters used in the experiment is analyzed by the two means, orthogonal analysis and RSM. The milling parameters include cutting speed, feed per tooth, and cutting depth. In contrast with the orthogonal analysis, the RSM is an optimization prediction model and has the higher precision in micro-milling. The significance order of the parameters in the prediction model is determined based on the result of the experiment. The cutting speed has the most significant effect on surface roughness, and the second and the third significant parameters are feed per tooth and the cutting depth respectively by the rounded analysis in the current experimental condition. The RSM prediction model has higher fitting degree and practicability than the orthogonal analysis method. The milling parameters can be chosen to control and improve the quality of the surface roughness based on the prediction model of RSM.

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