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整体壁板时效成形的回弹预测及模面补偿技术

黄霖¹, 万敏¹, 吴向东¹, 迟彩楼², 季秀升², 李善良³, 张新娟³

1 北京航空航天大学 飞行器制造工程系 2 沈阳飞机工业(集团) 有限责任公司 工艺研究所 3 西安飞机工业(集团) 有限责任公司 钣金总厂

Prediction of Springback and Tool Surface Modification Technology for Age Forming of Integral Panel

Huang Lin¹, Wan Min¹, Wu Xiangdong¹, Chi Cailou², Ji Xiusheng², Li Shanliang³, Zhang Xinjuan³

1 Department of Aircraft Manufacturing Engineering, Beijing University of Aeronautics and Astronautics 2 Technology Research Institute, Shenyang Aircraft Industry (Group) Company LTD 3 Sheet Metal Factory, Xi'an Aircraft Industry (Group) Company LTD

摘要

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摘要 时效成形是一种用于制造飞机整体壁板零件的成形工艺。由于其具有回弹量大的特点, 需要开发一种准确预测成形后回弹量的方法, 并在此基础上对模具型面进行补偿, 以消除回弹对成形精度的影响。本文将有限元法应用于网格式高筋壁板时效成形及回弹的分析, 并通过实验验证了有限元预测回弹量的准确性。提出了一种基于有限元回弹预测的适用于铝合金时效成形的模具型面补偿算法, 并应用该算法进行了复杂高筋整体壁板局部件时效成形的修模计算分析。通过9次迭代计算, 零件成形误差减小到0.4 mm以内, 证明了该算法具有收敛速度快、精度高的优点。

关键词: 整体壁板 时效成形 有限元 回弹 模具设计

Abstract: Age forming technique has been developed to manufacture integral wing-skin panel components. A method of accurately predicting springback and modifying tool surface to eliminate the effect of the springback on forming precision should be developed, since huge amount of springback is a characteristic of this forming technology. This article uses finite element method (FEM) to analyze the age forming process of grid type high flange integral panels, and test results show that FEM analysis results are reliable. Based on the FEM prediction of springback, a tool surface modification algorithm is developed for the age forming of integral aluminum panels. This algorithm is used in tool surface modification for the age forming of a complex high flange integral panel part. After 9 iterations, the maximal shape error of the panel part is reduced to below 0.4 mm. Its advantages of high precision and fast convergence rate have been confirmed.

Keywords: integral panel age forming finite element method springback die design

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Corresponding Authors: 黄霖

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