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单面螺纹抽钉干涉配合复合材料连接件挤压强度研究

魏景超¹, 矫桂琼¹, 闫照明², 刘风雷³

1. 西北工业大学 力学与土木建筑学院, 陕西 西安 710129;
2. 中国商飞 上海飞机设计研究院, 上海 201210;
3. 北京航空制造工程研究所, 北京 100024

Bearing Strength of Composite Joints Interference-fitted with Blind Bolts

WEI Jingchao¹, JIAO Guiqiong¹, YAN Zhaoming², LIU Fenglei³

1. School of Mechanics, Civil Engineering & Architecture, Northwestern Polytechnical University, Xi'an 710129, China;
2. Shanghai Aircraft Design and Research Institute, COMAC, Shanghai 201210, China;
3. Beijing Aeronautical Manufacturing Technology Research Institute, Beijing 100024, China

摘要

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摘要

由于连接技术是复合材料连接结构设计中的关键环节,所以本文通过试验研究了干涉配合对复合材料单钉双剪连接件挤压强度的影响作用,并建立了能预测复合材料连接件挤压强度的三维有限元数值模型。该模型考虑了钉孔接触、渐进损伤以及大变形理论,并采用了Hashin失效判据以及Tan材料性能退化准则,研究了不同干涉量(0%,0.5%,3%)配合方式对连接强度和刚度的影响作用。结果表明适量的干涉能提高连接挤压强度,而3%的过量干涉配合降低了连接挤压强度,却有较高的挤压弦向刚度,与试验结果相比,吻合较好。

关键词: 复合材料 单面螺纹抽钉 干涉配合 紧固连接件 渐进损伤

Abstract:

Since the join technology is the key link of the structural design of composite connection, an investigation is conducted to study the effect of interference fit on the bearing strength of composite single-bolt double-lap joints, and a three-dimensional finite element model is developed to predict the bearing strength of composite bolted joints with different sizes of interference fit, taking into account the bolt-hole connection, progressive damage, and large deformation theory. To predict progressive ply failure, Hashin failure criteria and Tan degradation rules are employed. This model considers the effects of different interference sizes (0%, 0.5%, 3%) on the bearing strength and stiffness of composite joints. Results show that appropriate sizes of interference can improve the bearing strength of joints. However, the joints of 3% excessive interference fit have lower bearing strength and higher bearing stiffness. Good agreement between experimental results and numerical predictions is observed.

Keywords: composites blind bolt interference fit fastened joint progressive damage

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Corresponding Authors: 矫桂琼 Email: jiaogq@nwpu.edu.cn

About author: 魏景超,男,博士研究生。主要研究方向:复合材料力学及先进复合材料在航空航天结构上的设计与应用。Tel:029-88431027,E-mail:weijingchao66@aliyun.com; 矫桂琼,男,教授,博士生导师,兼任中国力学学会常务理事、中国复合材料学会理事。主要研究方向:先进复合材料在航空航天结构上应用的力学问题、复合材料的损伤、断裂及其力学机理、复合材料力学行为的数值模拟及仿真、复合材料的界面力学、复合材料的层间增韧及其机理、多相材料的尺度效应等。Tel:029-88431023,E-mail:jiaogq@nwpu.edu.cn

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