

Comparative Experimental Study on Vibration Fatigue of TC4 Titanium Alloy Riveted Structures in Thermo-Vibration Coupled Environment: Postprint

Authors: Liu Jianghua¹, Lü Jinfeng¹, Zhao Nan¹, Wang Chun²

Date: 2023-11-10T00:00:00+00:00

Abstract

Titanium alloy materials are widely used in aircraft structural design and are susceptible to thermo-vibration coupled fatigue failure in harsh vibration and thermal coupling environments, which seriously affects aircraft flight safety. To obtain optimal detailed configurations of titanium alloy structures under thermo-vibration coupled environments, test specimens and test systems for thermo-vibration coupled vibration fatigue were designed, and vibration fatigue tests were conducted at 150 °C on test specimens comprising TC4 titanium alloy skin riveted with different structural support forms and different rivet types (semi-circular head rivets and flush-type blind rivets). Through statistical analysis and comparison of the test results, the following conclusions were drawn: for test specimens of the same structural type with identical width and rivet quantity, the flush-type blind rivet connected specimens exhibit relatively higher natural frequencies; for specimens with identical width and rivet type but different rivet quantities, those with more rivets possess higher natural frequencies; failures in semi-circular head rivet connections predominantly manifest as rivet pull-out, while failures in blind rivet connections manifest as skin cracking; blind rivet connections demonstrate longer vibration fatigue life compared to semi-circular head rivet connections; the test compared blind rivet connection structures with rivet spacings of 6 times and 4 times the rivet diameter, and specimens with 6 times rivet diameter spacing exhibited longer vibration fatigue life. These test conclusions can serve as important references for thin-walled structural design in aircraft structural design.

Full Text

Preamble

The source document is extensively corrupted by OCR artifacts and encoding errors, which precludes reliable translation of substantive content. The only identifiable elements are journal markers indicating “ChinaXiv Cooperative Journal” and numerous mathematical placeholders distributed throughout the corrupted data stream. All mathematical expressions must be preserved in their original form as `MATH_*` placeholders.

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.