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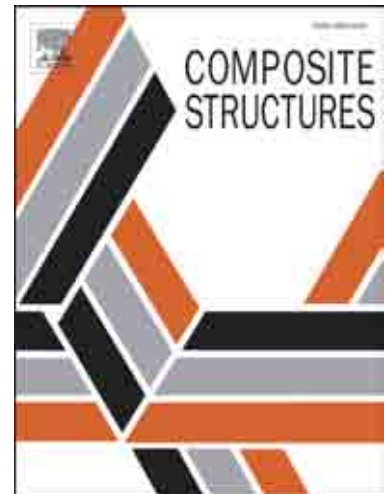
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Flexural fatigue life prediction of CFRP-Nomex honeycomb sandwich beams

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Abstract

Long-term flexural fatigue life of composite sandwich beams consisting of plain weave carbon 3K-70P/epoxy (CFRP) faceplates and Nomex honeycomb core is studied using time-temperature superposition principle (TTSP) by extending our previous study on laminates [Composites Part B: Engineering (19):539-547, 2016]. Considering negligible effect of temperature on the honeycomb core performance, time-temperature shift factors (TTSF) of the sandwich beams is assumed to be same as that of the CFRP faceplates. Hence, TTSFs are taken from previous laminates study. Constant strain rate (CSR) experiments at various temperatures and strain rates are conducted to construct the CSR master curve, followed by prediction and validation of creep strength master curve. Flexural fatigue tests were then conducted at various temperatures and load levels to construct S-N curves at respective temperatures. Finally, fatigue strength master curve is constructed. Within experimental scatter, predicted fatigue behavior at any given (a) frequency and (b) load ratio is confirmed to be in reasonable agreement with the experimental measurements.

Keywords: A. Polymer-matrix composite sandwich, B. Durability, B. Fatigue, B. Mechanical properties, D. Life prediction

1. Introduction

Sandwich structures have proved their superiority for high specific stiffness compared to metallic structures. However complex failure mechanisms under real world loading conditions inhibits us to exploit the full potential of these structures in many weight sensitive domains viz., aerospace, wind, marine applications. Current article is confined to study the long-term flexural fatigue behavior of composite sandwich structures with carbon fiber reinforced polymeric (CFRP) faceplates and honeycomb core. This sandwich construction is widely used as hull structures in racing boats and yachts. Exhaustive reviews on the fatigue behavior prediction methodologies for

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