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Book of Abstracts

Nicholas Fantuzzi

Michele Bacciocchi

António J.M. Ferreira

Modifying Stiffness Degradation Model and Validation Using Non-Destructive Modal Analysis in Glass Fiber-Reinforced Composites Under Fatigue Loading

Valizadeh, Pouya (pouya.vali85@gmail.com), Ferdowsi University of Mashhad, Iran, Sun Air Research Institute, Department of Materials Science and Engineering, Mashhad, Iran
Ahad, Zabett (ahad@um.ac.ir), Ferdowsi University of Mashhad, Iran, Sun Air Research Institute, Department of Materials Science and Engineering, Mashhad, Iran
Jalil Rezaeepazhand (jrezaeep@um.ac.ir), Ferdowsi University of Mashhad, Iran, Smart and Composite Structures Lab, Department of Mechanical Engineering, Mashhad, Iran

abst. 1412
Room GALLA PLACIDIA
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Residual strength and stiffness models are widely employed for predicting the remaining life of composite structures, particularly in wind turbine blades. However, time-consuming, destructive, and costly residual strength tests present significant challenges for improving these models using experimental data. In this study, first, the correlation between the degredated E-Modoulous tensile strength and modal analysis parameter (the first mode of natural frequency) of the cross-ply glass eposy laminat [0/90]7 was calculated experimentally. Next, the Shokrieh and Lessard's stiffness degradation model was modifyed using experimental test results, with particular focus on lower fatigue life percentages. Subsequently, the updated progressive fatigue damage stiffness degradation model was implemented using the UMAT subroutine in the ABAQUS finite element software. An analytical model, mimicking the composite specimen under tensile-tensile longitudinal fatigue loading, was created at stress levels similar to those in the experimental tests. The first mode natural frequency was analytically calculated at fatigue life percentages of 5%, 10%, 35%, 50%, and 70%. The results showed a good agreement between the analytical and experimental findings.