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Analytical and numerical investigation of coupled hygro-thermo-mechanical model of multi-layers bonded structure

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Abstract

Thermal and moisture exposure conditions have a deleterious effect on the integrity of bonded structure. The aim of this study is to investigate the effect of thermal expansion coefficient and moisture stress distribution of multi-layers bonded structure subjected to mechanical tension. A coupled hygro-thermo-mechanical model is proposed in order to show stress due to thermal and moisture strain on each layer of the multilayers bonded structure. The proposed model based on physical mechanical law while the thermal and moisture diffusion strain are obtained from Fourier and Fick's laws respectively. Finite element stress analysis is undertaken and good agreement is found between analytical and numerical results.

Keywords: Hygro-thermo-mechanical analysis, multilayers bonded structure; stress distribution; finite element stress analysis.

1. Introduction

Nowdays, multi-layers materials are used in a wide range of applications in aerospace, marine, automotive, transport and sports. A very good mechanical performance with high resistance to environment condition changes are the most qualities required for industrial applications. The multilayers structure can satisfy this major requirement by using different

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