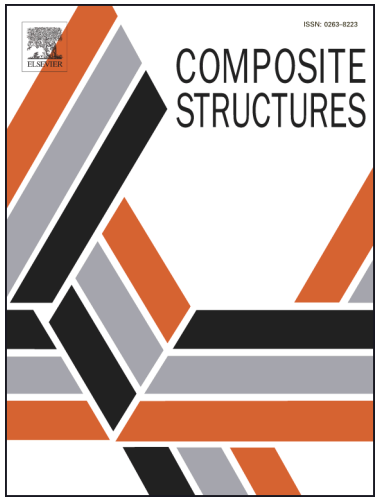


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# Postbuckling and failure analysis of stiffened composite panels subjected to hydro/thermal/mechanical coupled environment under axial compression

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**Abstract:** The postbuckling and failure behavior of stiffened composite panels subjected to hydro/thermal/mechanical coupled environment is investigated in this paper. The degradation in material properties due to moisture and temperature is taken into account using a micromechanical model. An effective model based on ABAQUS software has been established to evaluate the postbuckling load and failure load of stiffened composite panels. Excellent agreement between experimental data and numerical results is observed. Based on the model, the effects of temperature rise and moisture concentration on buckling and postbuckling response of the plate are presented.

*Keywords:* **stiffened composite panel; postbuckling; hydro/thermal/mechanical coupled environment; finite element model (FEM); failure**

## 1. Introduction

Composite materials are being increasingly used in aerospace, mechanics, naval and other high-performance engineering applications due to their light weight, high specific strength and stiffness, excellent thermal characteristics. Structures used in the above fields are more often exposed to high temperature as well as moisture. Environmental conditions due to moisture absorption and temperature seem to have a significant effect on the stability and strength of the structural composites. Increase in temperature and moisture concentration decreases the stiffness, thus lowering the strength of the structure and its stability [1]. Stability is one of the major criteria for design of the panel structures. Hygrothermal stresses and deformations play the significant role in their design. Accurate prediction of the postbuckling and failure response of the fiber composite laminated structures is required for efficient and optimal use of the materials. Therefore, it is necessary to study on the effect of environmental conditions on buckling, postbuckling and failure performance of the composites structure.

In recent years, considerable amount of work on the stability behavior of laminated composite plates subjected to thermal moisture absorption or mechanical loadings has been carried out by many researchers[2-9]. Whitney and Ashton [10] presented the hygrothermal effects on bending, buckling, and vibration of composite laminated plates. Flaggs and Vinson[11]studied the hygrothermal effects on the buckling of laminated composite plates. Chao and Shyu [12] presented a micro- to macroanalytical model for estimation of buckling loads of composite laminated plates subjected to hygrothermal loading conditions. Shen [13] studied the influence of hygrothermal effects on the postbuckling response of simply supported shear deformable laminated plates using Reddy's higher order shear deformation plate theory and employing perturbation technique. Se-Hee Oh, Kwang-Soo Kim and Chun-Gon Kim [14] used a commercial code, ABAQUS to suggest an efficient postbuckling analysis techniques for the composite stiffened shell structure and in order to reduce the computational time, accelerated analysis techniques were proposed. A.C. Orifici, R.S. Thomson and R. Degenhardt [15] established a model to

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