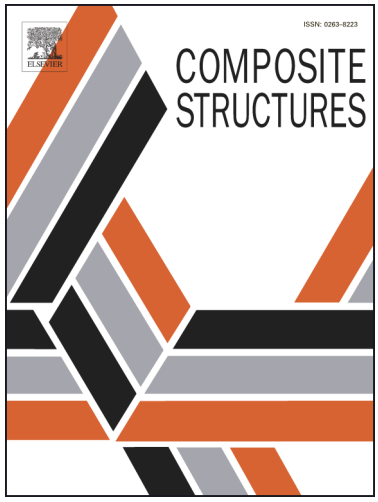

Buckling of uniaxially compressed composite anisogrid lattice plate with clamped edges

A.V. Lopatin, E.V. Morozov, A.V. Shatov

PII: S0263-8223(16)30606-7
DOI: http://dx.doi.org/10.1016/j.compstruct.2016.08.034
Reference: COST 7715

To appear in: *Composite Structures*

Received Date: 14 May 2016
Revised Date: 5 August 2016
Accepted Date: 28 August 2016

Please cite this article as: Lopatin, A.V., Morozov, E.V., Shatov, A.V., Buckling of uniaxially compressed composite anisogrid lattice plate with clamped edges, *Composite Structures* (2016), doi: http://dx.doi.org/10.1016/j.compstruct.2016.08.034

Buckling of uniaxially compressed composite anisogrid lattice plate with clamped edges

A.V. Lopatin[a], E.V. Morozov[*b], A.V. Shatov[a]

[a]Department of Aerospace Engineering, Siberian State Aerospace University, Krasnoyarsk, Russia

[b]School of Engineering and Information Technology, University of New South Wales at the Australian Defence Force Academy, Canberra, Australia

Abstract

An analytical solution of the buckling problem for a uniaxially compressed composite lattice plate with the clamped edges is presented in this paper. The compressive load acting in-plane and applied to the two opposite sides of the plate induces compression in the orthogonal direction due to Poisson effect. The lattice plate composed of the diagonal and transverse ribs is modelled as an equivalent orthotropic plate with effective stiffness parameters. The deflection of buckled plate is approximated using the mode shape functions of a clamped-clamped beam. A formula providing fast and reliable way of calculation of the critical buckling load is derived and applied to the analyses of the plates with various parameters of lattice structures. The results are verified using a finite-element method. Based on these calculations, the significance of the allowance for Poisson effect is demonstrated. An estimation of the mass efficiency of the lattice plates designed for a required critical load is presented. The solution obtained in this work provides an efficient analytical tool for the design and analysis of prismatic shells composed of composite lattice panels and subjected to axial compressive loading.

Keywords: Composite anisogrid lattice prismatic shell; Composite anisogrid lattice plate; Clamped edges; Buckling analysis; Galerkin method; Finite-element analysis.

1. Introduction

Most of the composite lattice structures, utilised in the aerospace design applications, are made in the form of circular cylindrical or conical shells. Such shells are characterised by high mass efficiency and often used as adapters providing mechanical interface between spacecraft and launcher, interstage sections of the launcher, and load-carrying bodies of spacecraft structures [1]. These shells are usually made of composite materials by filament-

[*] Corresponding author. *E-mail address:* e.morozov@adfa.edu.au (E.V. Morozov)