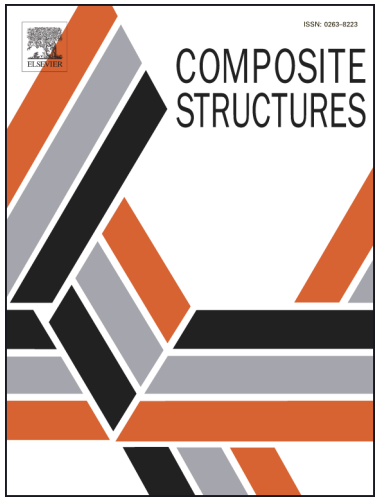

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Mathematical models for quantifying flexible multilayer orthotropic shells under transverse shear stresses

J. Awrejcewicz[1], V.A. Krysko [2], M.V. Zhigalov [3], I.V. Papkova [4], V.A. Krysko- jr.[5]

[1] *Department of Automation, Biomechanics and Mechatronics, Lodz University of Technology, 1/15 Stefanowskiego St., 90-924 Lodz, POLAND; awrejcew@p.lodz.pl*

[2]*Department of Mathematics and Modeling, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, RUSSIAN FEDERATION; tak@san.ru*

[3] *Department of Mathematics and Modeling, Saratov State Technical University, 77 Politehnicheskaya Str., 410054 Saratov, RUSSIAN FEDERATION; (zhigalovm@ya.ru)*

[4] *Department of Mathematics and Modeling, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, RUSSIAN FEDERATION; (ikravzova@mail.ru)*

[5]*Department of Mathematics and Modeling, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, RUSSIAN FEDERATION; (vadimakrysko@gmail.com)*

Abstract. In this work, a mathematical model of multilayer orthotropic shells with the account of both the 3rd-order generalized model (the so-called Grigoluk-Kulikov model) and a temperature field is presented. An asymptotically stable modified model is proposed. The reported conservative difference schemes associated with the considered models are developed based on the variational-difference method. The stability of a symmetric/non-symmetric pack of layers is addressed. In particular, the influence of the number of layers on the shell stability properties is illustrated and discussed.

Key words: multilayer orthotropic shells, Grigoluk-Kulikov model, asymptotically stable model, variational finite difference method, symmetric/non-symmetric pack of layers.

1. Introduction

Multilayer shells made from composite materials are used in aircraft fuselages, cosmic apparatuses, rockets, vehicles, submarines, and roofs of buildings. This wide spectrum of applications results from the required high or low, depending on the needs, specific material resistance, robust and stable response against complex loads (excitations), temperature characteristics, and simplicity of fabrication. Since large deflections of engineering constructions may cause collapses, in the engineering-oriented investigations, the key role is played by stability of the investigated object, which requires knowledge of numerically or experimentally obtained solutions.

As far as the theory for multilayer shells is concerned, one can classify mathematical models based on quantifying if the number of unknown parameters is dependent or independent on a