To the satisfaction of boundary conditions on the surfaces of thin-walled elastic structures and an extension methods of complex analysis for some essential nonlinear DEs

Tamaz Vashakmadze
I. Vekua Institute of Applied Mathematics & Department of Mathematics
Faculty of Exact and Natural Sciences
Iv. Javakhishvili Tbilisi State University

The basic problem of satisfaction of boundary conditions is considered when the generalized stress vector is given on the surfaces of elastic plates and shells. This problem has so far remained open for both refined theories in a wide sense and hierarchic type models. In the linear case, it was formulated by I.N. Vekua for hierarchic models. In the nonlinear case, bending and compression-expansion processes do not split and in this context the exact structure is presented for the system of differential equations of von Kármán-Mindlin–Reisner type, constructed without using a variety of ad hoc assumptions since one of the two relations of this system in the classical form is the compatibility condition, but not the equilibrium equation. In this paper, a unity mathematical theory is elaborated in both linear and nonlinear cases for anisotropic inhomogeneous elastic thin-walled structures. The theory approximately satisfies the corresponding system of partial differential equations and the boundary conditions on the surfaces of such structures. The problem is investigated and solved for hierarchic models too. The obtained results broaden the sphere of applications of complex analysis methods. The classical theory of finding a general solution of partial differential equations of complex analysis, which in the linear case was thoroughly developed in the works of Goursat, Weyl, Walsh, Bergman, Kolosov, Muskhelishvili, Bers, Vekua and others, is extended to the solution of basic nonlinear differential equations containing the nonlinear summand, which is a composition of Laplace and Monge–Ampére operators.