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DEFORMATIONS WITHOUT BENDING: EXPLICIT EXAMPLES

VLADIMIR I. PULOV, MARIANA TS. HADZHILAZOVA† and
IVAÏLO M. MLADENOV†

Department of Physics, Technical University of Varna, Studentska Str. 1, 9010 Varna Bulgaria

†*Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences Acad. G. Bonchev Str., Block 21, 1113 Sofia, Bulgaria*

Abstract. Here we consider an interesting class of free of bending deformations of thin axial symmetric shells subjected to uniform normal pressure. The meridional k_μ and the parallel k_π principal curvatures of the middle surfaces of such shells obey the non-linear relationship $k_\mu = 2ak_\pi^2 + 3k_\pi$, $a = \mathrm{const}$. These non-bending shells depend on two arbitrary parameters, which are the principal radii r_μ and r_π of some fixed parallel of the shell. Besides, these surfaces have no closed form description in elementary functions. Our principle aim here is to present such a parameterization of the whole class of non-bending closed surfaces by making use of the canonical forms of the elliptic integrals. The obtained explicit formulas are then applied for the derivation of the basic geometrical characteristics of these surfaces.

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1. Deformations Without Bending

In the theory of deformable thin-shell structures it is of vital importance to describe geometrically as well as physically the joint effect of all stress resultants that under the external loads preserve the equilibrium of the shell. A typical type of a thin-walled shell which is used as structural element in a variety of practical applications, e.g. pressure vessels, tanks, air-supported envelopes, etc., is a *symmetrically loaded shell of revolution*. Here we are interested in what the shape of such