On the theory of sandwich shells, plates, and beams with light core

Konstantin Y Volokh iD

Faculty of Civil and Environmental Engineering, Technion—Israel Institute of Technology, Haifa, Israel

This journal published an impressive historical overview of analyses of sandwich structures [1]. Remarkably, the names of those who did not write in English were not forgotten, e.g., Alexey Rufovich Rzhanitsyn—unusually creative scientist and prolific writer. Whatever in-depth work has been done by the authors, some room for further remarks and corrections always remains.

In this short letter, I would like to draw the reader's attention to a less-known yet a milestone work by Alexey Alexeyevich Gorshkov, who pioneered a general theory of sandwich shells with the light core. His original contribution appeared in 1986 in the Soviet journal entitled *Stroitelnaya Mekhanika I Raschet Sooruzhenii* (*Structural Mechanics and Design of Structures*) [2]. I could not find its English translation. However, Gorshkov's paper, in which the general theory was applied to analysis of a circular plate, was available in English translation [3].

The essence of the Gorshkov theory is simply expressed without formulas [3]: "The filler is considered to be a three-dimensional, transversely-isotropic body with zero value for Young's modulus in the tangential directions and zero value of Poisson's ratio, which characterizes lateral compression when the body experiences tension in the plane of isotropy." These assumptions allow directly integrating the equations of the linear elasticity for the core without introducing ad hoc kinematic postulates.

In 1992, Frostig with co-authors used the above-mentioned theory for analysis of a beam with the light core [4]. In the latter paper, as well as in many subsequent publications by this author, no reference to the original Gorshkov theory could be found, unfortunately. Published in the West and in English, numerous papers by Frostig and his collaborators make inaccurate impression concerning the priority issue, which is a sensitive matter in science.

I hope this short letter provides some historical justice and appreciates the remarkable scientific contribution of the late professor Gorshkov to the mechanics of sandwich structures.

ORCID iD

Konstantin Y Volokh iD https://orcid.org/0000-0002-2770-3916

Corresponding author:
Konstantin Y Volokh, Faculty of Civil and Environmental Engineering, Technion—Israel Institute of Technology, Haifa 3200003, Israel.
Email: cvolokh@technion.ac.il

References

[1] Challamel, N, Atashipour, SR, Girhammar, UA, et al. A historical overview on static and dynamic analyses of sandwich or partially composite beams and plates. *Math Mech Solids*. Epub ahead of print 21 December 2012. DOI: 10.1177/1081286524128989.

[2] Gorshkov, AA. Equations of thermoelasticity of three-layered shells with a light compressible filler. *Stroitelnaya Mekhanika I Raschet Sooruzhenii* 1986; 3: 24–28. (In Russian)

[3] Gorshkov, AA. Equations of three-layered circular plate with a light compressible filler. *Sov J Struct Mech* 1989; 2(2): 1–9.

[4] Frostig, Y, Baruch, M, Vilnay, O, et al. Higher-order theory of sandwich beam behavior with transversely flexible core. *ASCE J Eng Mech* 1992; 118(5): 1026–1043.