APPLICATION OF THE FINITE LAYER METHOD TO ANALYZE THE STRESS-STRAIN STATE OF MULTILINK SHELL STRUCTURE

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Abstract: The finite layer method is developed for a subclass of multilink axisymmetric shell structures. The structures are considered as multilayer shells with layers of different geometry.
Key words: multilink structure, interlayer stresses, finite layer method

Calculation methods for multilink shell structures are well developed. Universal computing systems have been created based on the exact numerical solution of boundary value problems for systems of differential equations of shell theory [1, p. 46]. The structures are considered as a set of spandrels-nodes and bond shells connecting them. The calculation involves the solution of a statically indeterminate problem and requires multiple solutions of boundary value problems for the bond-shells. Usually the zones of local wall thickenings are considered as single-layer thicker shells. In structures made of composite materials, such thickenings are often formed by joining layers of materials with different physical and mechanical characteristics [2, p. 233]. Under the action of loads, interlayer normal and tangential stresses occur here. These stresses are decisive for evaluating the interlayer strength of the joint. A finite layer method for calculating such stresses is proposed, where it is used to analyze structural elements in the form of a beam-strip with layers of different lengths. The developed calculation algorithm gives the values of all functions describing the stress-strain state of the multilayer structure, including the interlayer stresses on the surfaces of the layers' connection. Disclosure of static indeterminacy by solving the system of canonical equations of the displacement method is replaced by the conditions of equality of displacements of the contact surfaces of the layers, which are used at the stage of formation of the solving system of differential equations. This allows the calculation of the structure to be performed by a single solution of the boundary value problem for all layers simultaneously.

References

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