Proceedings of the 5th International Conference on Nonlinear Dynamics
ND-KhPI2016
September 27-30, 2016, Kharkov, Ukraine

Developing Structural Methods For Solving Boundary-Value Problems In Non-Smooth Boundary Domains

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Abstract
The paper presents the development of structural methods for solving boundary-value problems in complex-shape domains to enhance calculation accuracy in the neighbourhood of angular points in the boundary-value problems solution domain.

Structural methods allow building bases for solving mathematical physics boundary-value problems, which accurately account for the boundary conditions and geometric information on the domain form. These methods are based on using the mathematical tools of the theory of R-functions. They can dramatically extend the potentialities of variation methods when solving mathematical physics boundary-value problems in complex-shape domains with different boundary conditions.

The most common systems of R-operations used in practice are normalised; however, they are not smooth in point (0,0), and all smooth R-operations are not normalised.

The paper presents the results of investigating the behaviour of smooth functions up to the domain boundary, which satisfy uniform Dirichlet and Neumann conditions, and the condition at which the function proper and its derivatives over the normal to a definite order are equal to zero. New approaches are offered to build basis functions that are smooth up to the non-smooth domain boundary and which meet the above-mentioned boundary conditions.

The suggested new system of asymptotically normalised R-operations whose functions belong to the given smoothness class can be used to build smooth basis functions that satisfy certain boundary conditions.

The approaches developed were tested for model problems, some of which were used for problems in modelling hydrodynamic fields in complex-shape domains.

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