SOLUTION OF INTEGRAL EQUATIONS FOR CONTACT PROBLEMS WITH USE OF POTENTIAL EXPANSION

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Mathematical modeling of contact interaction leads to solution of integral equations containing simple fiber potentials. Analytic dependences for the potential calculation over ring are received, expressing integral operator kernels by Gegenbauer's polynomials.

Small parameter expansions for doubly-connected domain limited by smooth curves are made using differentiation of the potentials by Tricomi, Mikhlin. Expansions contain potentials distributed over ring. Analyzing contact problems, small parameter could depend on friction coefficient, adhesion, roughness, punch shape.

Unified mathematical model for contact problems solution based on potential theory accounting friction, roughness or without them is proposed. Reduction of boundary problems over doubly-connected domain to sequences of problems over ring is made. Exact analytic solutions in form of series, with coefficients exactly got for any index, are developed for first kind integral equations.

By means of cubature formulae, two-dimensional integral equations are reduced to algebraic equation systems, when doubly-connected and multi-connected integration domains are known. In case of unknown contact domain, considered potential expansion for reduction into sequence of problems over ring is suggested. When density satisfies Lipschitz condition with positive power index, the expansion is presented in the form of two-dimensional integrals with the same singularity. Besides, method of reduction to one-dimensional integral equations is worked up.

Considering nonlinear laws of friction, roughness, nonlinear Urysohn, Hammerstein integral equations are solved similarly.

Concrete problems are solved by analytical and numerical methods and compared.

[1] *Goryacheva I., Dobychin M.* Contact problems in tribology. – Moscow, 256p., 1988
[2] *Shyshkanova G.* About definition method of integrals with weak singularity for three-dimensional contact problems. – J. MSAPSM, v.5, Dniepropetrovsk, p.127-136, 2003
[3] *Shyshkanova G.* Solution for the three-dimensional problem of punch motion taking into account forces of friction, adhesion. – Mechanika-2003. Proceedings, Kaunas, p.311-316, 2003