Title: Application of Integral Equation Method to some Linear and Nonlinear Problems of Fluid Dynamics

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Abstract: Mixed Boundary Value Problems occur in a natural way while modelling many problems of physics and engineering, especially fluid dynamics. While understanding the applications of such boundary value problems is of immense value to the physicists and engineers, determining their solutions by utilizing the most appropriate analytical or numerical method is a concern for applied mathematicians. In this talk, first, the problem of propagation of surface water waves over a pair of asymmetrical rectangular trenches in a channel of finite depth is examined for its solution with the aid of a system of singular integral equations of first kind. The resulting integral equations are solved numerically by using suitably designed polynomial approximations of the unknown functions. The effectiveness of the pair of trenches is studied by analyzing the physical quantities, namely, the reflection and transmission coefficients. As a second case, the nonlinear inviscid flow over an arbitrary bottom topography is formulated as a nonlinear boundary value problem which is reduced to a Dirichlet problem using certain transformations. The Dirichlet problem is solved by applying Plemelj-Sokhotski formulas and it is noticed that the solution of the Dirichlet problem depends on the solution of a coupled Fredholm integral equation of the second kind. These integral equations are solved numerically by using a modified method.