INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: WATER WAVE INTERACTION WITH DIFFERENT STRUCTURES AND OBSTACLES DUE TO VARIOUS TYPES OF BOTTOM TOPOGRAPHY IN A HOMOGENEOUS FLUID AND A TWO-LAYER FLUID

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SHORT ABSTRACT

Water wave propagation over variable topographies has long been of great interest to scientists and engineers, due to its importance in coastal and oceanographic applications. On the other hand, perforated/wave absorbing structures of various configurations are being used in the coastal countries to protect coastal infrastructures/facilities from unpredictable and harsh wave actions. Some other naturally formed dissipative media include the likes of muddy or sandy ocean bed in which water can penetrate the sea-bed and underwater vegetation field which resists the wave motion and dissipate incoming wave energy. Realizing the importance of wave scattering by elastic beds, we are immensely motivated to study the propagation of water waves in a homogeneous fluid and a two-layer fluid with the upper surface having different geometry and the lower surface having dissipative (mainly, elastic and porous) properties. Subsequently, we carry out an extensive analytical and mathematical modelling to throw light on issues like water wave scattering over a dissipative sea-bed and water wave interaction with different types of structures. In this thesis, two types of problems are investigated: (i) the water wave scattering by a small undulation of an elastic sea-bed in a two-layer fluid of finite depth, which is bounded by either a free surface or a rigid flat structure or a very thin ice-sheet; (ii) the interaction of water waves by dual submerged porous barriers in a homogeneous fluid subject to different upper surface and bottom boundary conditions under such situations. The mathematical tools utilized to solve those problems are (a) Fourier transform technique and application of residue theorem, (b) the eigenfunction expansion method, and (c) least square method. For scattering problems of undulating bottom topography, reflection and transmission coefficients are obtained for various structural parameters. On the other hand, for scattering problems of porous barriers, reflection and transmission coefficient, energy loss, hydrodynamic wave force are obtained for different structural parameters of the respective physical model.