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Oscillations within and on a fluid enclosed by arbitrary boundaries

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A number of problems describing oscillations of a fluid in regions defined by arbitrary boundaries are examined in this thesis. The arbitrary boundaries are subject to linear theory as a first restriction. In one-dimensional flow problems the boundary is required to be such that transverse oscillations are negligible, but with two-dimensional flow no further restriction is required. The treatment is twofold in that it firstly attempts to incorporate general boundary shapes so that the mathematics is tractable and secondly devises faster numerical techniques for the analysis of the fluid oscillations under different conditions.

In particular the mathematical preliminaries of Chapter 2 introduce the Galerkin method from the calculus of variations and indicate its use to a one-dimensional flow problem of free oscillations. The following three chapters adapt and extend this method to treat

(i) free oscillations in a region where two-dimensional flow is considered,

(ii) forced oscillations in estuaries, and

(iii) internal oscillations in a two-layered fluid.

For each of these categories the boundary shape of the region is arbitrary except for the restrictions mentioned above.

By virtue of this use of the Galerkin method, or otherwise, it is then shown in Chapter 6 how the dynamic response to wind stress of a fluid in an elongated basin, but with variable shape, may be analysed. In earlier

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approaches the basin shape was crudely approximated by a rectangular box.

The remainder of the thesis makes a determined study of continental shelf profiles and their effect on standing waves normal to the coast line on a rotating earth. It demonstrates the infancy of the shelf models used to date and puts forward an extended selection of models which may be used in a piecewise matching of the actual profile.