Some unfinished and unsolved problems in the linear theory of water waves,

by F. Ursell, Department of Mathematics, University of Manchester, M13 9PL, U.K.

Abstract

During his career the author has been involved in the study of many mathematical problems in the linear theory of water waves. Where mathematical solutions to these problems have been found they are in almost every case imcomplete and have suggested new problems. Examples are: uniqueness; the heaving circular cylinder, the long-wave and the short-wave treatment and the force coefficient in the complex frequency plane (needed for the transient motion); short-wave asymptotics for free oscillations in a two-dimensional container; and many other problems. Some of these unfinished problems will be described.

DISCUSSION

Kleinman: I agree with Nick Newman's comment that the integral equation obtained via Green's theorem exhibits irregular frequencies just like the equation obtained assuming only sources (layer *ansatz*). However, Green's theorem provides a second equation, via differentiation, and the pair is uniquely solvable at all frequencies. In this sense, methods based on Green's theorem appear superior, although proponents of the layer approach would claim that irregular frequencies can also be eliminated with a more sophisticated *ansatz*.

Ursell: There are many ways of removing irregular frequencies (or of moving them from the real-frequency axis), for instance, dissipative conditions inside the body. I have always found it paradoxical that such artificial procedures should be needed, and this is the point I wished to make in my lecture.