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The steady motion of a flat ship including an investigation of local flow near the bow

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This thesis concerns the flow produced by a ship-like body moving steadily across the surface of a fluid. The relevant equations are linearized using the assumption that the body is "flat"; that is, that its length and breadth are much greater than its draft. This leads to an integral equation to determine the pressure distribution under the hull. Various simplifying limiting cases of this equation are discussed.

It is first shown that if the wetted area of the body is prescribed then the hull shape is necessarily partly determined by the solution. Conversely, if the hull shape is prescribed, the extent to which it is wetted must be determined by the solution. This means that, for a given hull shape and location, the range of integration of the integral equation is one of the unknowns, a fact which has received insufficient consideration in previous theoretical work in this subject.

In the particular case of bodies of infinite span in two-dimensional flow, this indeterminacy reduces to indeterminacy (for a given hull shape and vertical location) about the wetted length. The problem can be solved in an inverse manner by fixing the wetted length and allowing the vertical location of the hull to be determined by the solution. An efficient numerical procedure is outlined for solving this problem at arbitrary Froude number, and the results presented for flat and parabolic surfaces. In the former case, comparison with previous solutions is given, as well as

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new forms of presentation of the results, which have relevance to the practical problem of planing boats. In the case of curved hulls, some consideration is given to the problem of finding the detachment point for non-sharp trailing edges.

For bodies of finite span, the limit as the Froude number tends to infinity is treated first, and it is demonstrated in particular that the assumption of a triangular wetted waterplane implies that the body has an approximately *V*-shaped hull. The case of three-dimensional flow at finite Froude number is also dealt with briefly.

Finally some consideration is given to the details of two-dimensional flow at the attachment point present at the bow. The exact non-linear free surface condition is used to derive a non-linear integral equation, which is solved in the high Froude number limit.

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