

The Initial Value Problem for the Linearized Equations of Water Waves, II

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1. Introduction. Let $x = (x', y) = (x_1, \dots, x_{n-1}, y)$ denote a variable point in R^n . Let G be a domain in R^n whose boundary consists of two parts, Γ and Γ' . Γ is an $(n - 1)$ -dimensional subdomain of the plane $y = 0$ and is conceived of as the free surface of a fluid that fills G . Γ' is a fixed boundary through which no fluid can flow. Let

$$\Delta = \sum_1^{n-1} \frac{\partial^2}{\partial x_i^2} + \frac{\partial^2}{\partial y^2},$$

let ν denote the outward normal to Γ' , and let subscripts denote differentiation. We seek a function $u(x, t)$ defined on $\bar{G} \times [0, \infty)$ satisfying the following equations:

$$(1.1) \quad \Delta u = 0 \quad \text{for } x \in G, \quad t \geq 0,$$

$$(1.2) \quad u_\nu = 0 \quad \text{for } x \in \Gamma', \quad t \geq 0,$$

$$(1.3) \quad u_y + u_{t,t} = 0 \quad \text{for } x \in \Gamma, \quad t \geq 0,$$

$$(1.4) \quad u = u^0, \quad u_t = u_t^0 \quad \text{for } x \in \Gamma \quad \text{when } t = 0.$$

Here, u^0 and u_t^0 are given functions, the initial data of the problem. t is time, which makes its sole appearance as a parameter with respect to which the unknown function u is differentiated. (See [1] for a derivation of (1.1-4) and a discussion of their physical significance.)

In a paper [1] with the same title as the present one, we solved the system (1.1-4) for very general domains G , the so-called *normal* domains. It was shown that conditions (1.1), (1.2), and (1.4) are satisfied classically but, in general, that (1.3) is satisfied only in a weak sense. With a bit of smoothness on the initial data, we showed that (1.3) is satisfied for almost all x' in Γ , but that was the best we could do.

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