Abstract View

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Application of a “Radiation-Type” Boundary Condition to the Wave, Porous Bed Problem

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ABSTRACT

The problem of a small-amplitude wave propagating over a flat porous bed is reanalyzed subject to the bottom boundary condition where *u* represents the horizontal velocity in the fluid, $\bar{u}_s$ represents the horizontal velocity within the bed as predicted by Darcey's law, *K* is the permeability and the subscript 0 denotes evaluation at the bottom (z=0). The term α is a constant whose value depends on the porosity of the bed at the interface and must be determined experimentally. The boundary condition is of the form of a “radiation-type” condition commonly encountered in heat conduction problems.

The important physical quantities (velocity, velocity potential, streamfunction, shear stress and energy dissipation) have been derived and are presented, subject to natural conditions. The bottom boundary layer is represented by the linearized Navier-Stokes equations under the usual boundary layer approximation. It is found that the boundary layer velocity distribution and shear stress can be greatly altered from impermeable bed predictions. Theoretical results for energy dissipation and shear stress are compared to existing data and are found to agree very well. The predictions of classical small-amplitude wave theory are not appreciably modified away from the boundary.

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