On mean flows associated with traveling water waves

E. Knobloch

JILA, University of ColoradoBoulder, CO 80309USAUSA

R.D. Pierce

Department of Mathematics, The Pennsylvania State UniversityUniversity Park, PA 16802USAUSA

Received 17-FEB-97

The generation of mean flows by trains of traveling, inviscid water waves is investigated. All ambiguities associated with the velocity potential are resolved by treating uniform wave trains as limits of wave packets, and appealing to the conservation of mass and momentum. This formulation leads to a systematic multiple-scales description of weakly nonlinear wave trains and the associated mean flows. The results are compared with the amplitude equation formulation of Davey and Stewartson and radiation stress formulation of Longuet-Higgins and Stewart which do not conserve mass. The momentum of the wave train can be uniquely specified only by an analysis of the wave generation mechanism. The present theory is sufficiently general that mean flows arising from different generation mechanisms can be included, and shows that a recently proposed singularity associated with mean flows is absent. © 1998 The Japan Society of Fluid Mechanics Incorporated and Elsevier Science B.V. All rights reserved.

Copyright (c) 1998 Elsevier Science B.V. All rights reserved.