15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: MAT331

Gravity waves in channels with corrugated bottom: an asymptotic approach

Ryszard Wojnar, Włodzimierz Bielski

Abstract: We consider a propagation of long one-dimensional gravity waves of a homogeneous incompressible fluid in a channel with corrugated bottom (micro-periodic corrugation). If foreseeable wave disturbance is long, and if take it for a length unit, then we have the inequalities l << h << 1, where l denotes the period of the bottom corrugation, and h - the depth of channel liquid in equilibrium. The value of the bottom corrugation vertical amplitude a and the wave amplitude on the surface of the fluid, it is its vertical disturbance \eta, both are of the order of l. In an introductory discussion of the gravity waves problem we are dealing with two tasks: the linear approximation, which permits describe the phenomenon by the common wave equation with the velocity \sqrt{g h^{eff}} and the higher, non-linear approximation, which leads to Korteweg – de Vries equation. After writing appropriate gravity wave equations for the channel with periodic micro-corrugated bottom, we perform asymptotic homogenisation of the problems and obtain homogenised equations of long gravity waves in both cases. References: 1) Korteweg, D. J.; de Vries, G., On the change of form of long waves advancing in a rectangular canal, and on a new type of long stationary waves, Philosophical Magazine 39 (240) 422-443, 1895. 2) Lamb G. L., Jr., Elements of soliton theory , John Wiley & Sons, New York - Chichester - Brisbane - Toronto, 1980.

[1)] Ryszard Wojnar, Ph.D.: Institute of Fundamental Technological Research PAS, Pawińskiego 5B, 02-106 Warszawa, Poland (PL), rwojnar@ippt.pan.pl.

[2)] Włodzimierz Bielski, Associate Professor: Institute of Geophysics Polish Academy of Sciences, ul. Księcia Janusza 64, 01-452 Warsaw, Poland (PL), wbielski@igf.edu.pl.