

Synchronism of nonlinear internal waves in a three-layer fluid

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In a three layer fluid with arbitrary layer widths and densities the existence of long internal solitons and breathers is proven theoretically and numerically, see for example (Pelinovsky et al., 2007; Lamb et al., 2007). The existence of breather-like waves of the intermediate length is also shown in numerical simulations (Terletska et al., 2016). For such waves conditions of synchronism are valid when a breather of the first mode and a soliton of the second mode move together with the same speed and form an asymmetric solitary wave of the second mode. The process of strong interaction of long nonlinear internal waves in the framework of three-layer Camassa-Choi model demonstrates the same effect (Jo&Choi, 2014; Barros, 2016).

We analyze possible synchronism conditions for steady-state internal waves in a three-layer fluid analytically the framework of the Gardner equation, which is valid for long weakly nonlinear internal waves. The equations for synchronism conditions are derived and considered in terms of wave amplitudes, layer widths and density jumps. The configurations of three-layer fluid are found for which such a synchronism is possible.

References:

- Barros R. Large amplitude internal waves in three-layer flows. The forth international conference "Nonlinear Waves - Theory and Applications", MS7, Beijing, China, June 25 - 28, 2016
- Pelinovsky E., Polukhina O., Slunyaev A., Talipova T. Internal solitary waves // Chapter 4 in the book "Solitary Waves in Fluids". WIT Press. Southampton, Boston. 2007. P. 85 – 110.
- K. Terletska., K. T. Jung, T. Talipova, V. Maderich, I. Brovchenko and R. Grimshaw Internal breather-like wave generation by the second mode solitary wave interaction with a step// Physics of Fluids, 2016, accepted