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Zakharov–Kuznetsov Equation

Andrei V. Faminskii

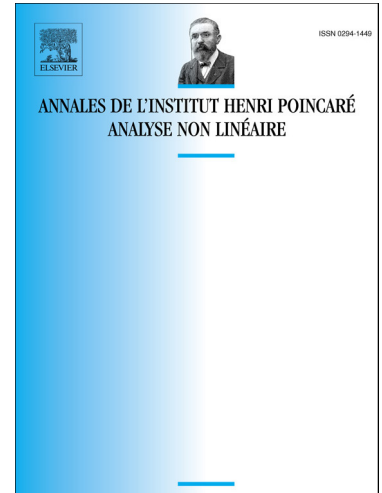
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**INITIAL-BOUNDARY VALUE PROBLEMS IN A HALF-STRIP
FOR TWO-DIMENSIONAL ZAKHAROV–KUZNETSOV
EQUATION**

ANDREI V. FAMINSKII

ABSTRACT. Initial-boundary value problems in a half-strip with different types of boundary conditions for two-dimensional Zakharov–Kuznetsov equation are considered. Results on global existence, uniqueness and long-time decay of weak and regular solutions are established.

1. INTRODUCTION. DESCRIPTION OF MAIN RESULTS

The two dimensional Zakharov–Kuznetsov equation (ZK)

$$u_t + bu_x + u_{xxx} + u_{xyy} + uu_x = f(t, x, y) \quad (1.1)$$

(b is a real constant) is a reduction of the three-dimensional one which was derived in [35] for description of ion-acoustic waves in magnetized plasma. Now this equation is considered as a model of two-dimensional nonlinear waves in dispersive media propagating in one preassigned (x) direction with deformations in the transverse (y) direction. A rigorous derivation of the ZK model can be found, for example, in [19, 21]. It is one of the variants of multi-dimensional generalizations for Korteweg–de Vries equation (KdV) $u_t + bu_x + u_{xxx} + uu_x = f(t, x)$.

The theory of solubility and well-posedness for ZK equation and its generalizations is most developed for the pure initial-value problem. For the considered two-dimensional case the corresponding results in different functional spaces can be found in [32, 6, 7, 2, 26, 27, 31, 15, 3, 18, 30, 16, 17]. For initial-boundary value problems the theory is most developed for domains of a type $I \times \mathbb{R}$, where I is an interval (bounded or unbounded) on the variable x , that is, the variable y varies in the whole line ([8, 9, 11, 10, 33, 12, 5]).

On the other hand, from the physical point of view boundary-value problems for this equation in domains, where the variable y varies in a bounded interval, seem at least the same important. Unfortunately certain technique developed for the case $y \in \mathbb{R}$ (especially related to profound investigation of the corresponding linear equation) up to this moment is extended to the case of bounded y only partially. An initial-boundary value problem in a strip $\mathbb{R} \times (0, L)$ with periodic boundary conditions was considered in [28] for ZK equation and local well-posedness result was established in the spaces H^s for $s > 3/2$. This result was improved in [30]

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