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Application of Krylov-Bogoliubov technique, nonlinear WKB method and boundary layer functions for constructing asymptotic solutions to Korteweg-de Vries equation with small perturbation

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Asymptotic techniques are effective tools for studying nonlinear differential equations with small perturbation, in particular, Korteweg-de Vries (KdV) equation.

KdV equation with a small parameter was firstly considered by M. Kruskal and R. Miura. Namely, in 1974 they proposed nonlinear WKB method and found main term of asymptotic series for quasiperiodic solution to singular perturbed KdV equation. In the 80-th years of last century V.P. Maslov and others applied the nonlinear WKB method for constructing asymptotic soliton type solutions to a number of singular perturbed close to integrable partial differential equations. Approximately at the same time P.D. Lax and S.D. Levermore studied a problem on weak limit of solution to Cauchy problem for singular perturbed KdV equation as small parameter tends to zero.

D. de Kerf should be also mentioned as one of the first who began studying regular perturbed KdV equation. In particular, in 1988 he constructed asymptotic solution to Cauchy problem for the one. Similar problems were considered by A.M. Ilyin and L.A. Kalyakin too. In 1992 and 1994 by means of Krylov-Bogoliubov technique they studied problem on regular disturbance of soliton solutions to KdV equation with small perturbation. In addition, in 2003 – 2005 S.G. Glebov, O.M. Kiselev and V.A. Lazarev by means of nonlinear WKB method constructed asymptotic solutions of KdV equation with special non-homogeneities.

Authors of the talk present results on constructing asymptotic soliton type solutions to singular perturbed KdV equation with variable coefficients as well as to Cauchy problem for the one.

In this connection boundary layer functions were applied for finding such solution to the Cauchy problem.