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Semilinear Sobolev Type Equations of Higher Order

Of concern is the semilinear Sobolev type equation of higher order with Cauchy and Showalter-Sidorov initial conditions. A unique solvability of the problem is proved. We use the ideas and techniques developed by G.A. Sviridyuk for the investigation of the Cauchy problem for a class of the first order semilinear Sobolev type equations and by A.A. Zamyshlyaeva for the investigation of the higher order linear Sobolev type equations. We consider two cases. The first one concerns the case when an operator A at the highest time derivative is continuously invertible. In this case for any initial data from the tangent bundle of the original Banach space there exists a unique solution lying in this space as a trajectory. The second case, when the operator A is not continuously invertible is of great interest for us. Here we use the phase space method. It consists in reducing a singular equation to a regular one which is defined on a subset of the original Banach space consisting of admissible initial values which is understood as a phase space. Under the condition of polynomial boundedness of operator pencil in the case where infinity is a removable singularity of its A-resolvent, a set, which is locally a phase space of the original equation, is constructed. Abstract results are applied to investigation of mathematical model of vibration in the DNA molecule and Bussinesq-Löve mathematical model.

References

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