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Sobolev Type Equations. Degenerate Semigroups of Operators and Degenerate Propagators

Sobolev type equations were firstly studied in the works of A. Poincare. Then they appeared in the works of S.V. Oseen, J.V. Boussinesq, S.G. Rossby and other researchers, that were dedicated to the investigation of some hydrodynamics problems. Their systematical study started in the middle of the XX century with the works of S.L. Sobolev. The first monograph devoted to the study of such equations appeared in 1999. Nowadays the number of works devoted to such equations is increasing extensively. Sometimes such equations are called equations that are not of Cauchy–Kovalevskaya type, pseudoparabolic equations, degenerate equations or equations unsolvable with respect to the highest derivative. The term "Sobolev type equations" was firstly proposed in the works of R. Showalter. Nowadays Sobolev type equations constitute the vast area in nonclassical equations of mathematical physics. The proposed theory of degenerate semigroups of operators is a suitable mathematical tool for the study of such equations. The theory is developing in different directions: optimal control problems, initial-final value problems, equations of high order, and finds applications in elasticity theory, fluid dynamics, oil production, economics, biology, and in the solution of many technical problems, for example in the theory of dynamic measurements.