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Inverse and Ill-Posed problems for nonlinear PDE: applications to life and social sciences

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Motivation and Aim: In mathematical models of life and social sciences, financial mathematics inverse and ill-posed problems are investigated for nonlinear convection-diffusion-reaction $u_t + (v,\nabla u) - \tilde{N}(k\nabla u) = A(q,u)$, where right-hand side A is nonlinear in q and u, respectively [1]. We consider the coefficient inverse problems of recovering v, k and q by nonlocal data (integral over the domain given in the discrete time) [2]. This data characterizes a certain reference group (social survey), medicine (drag absorption) or financial market. Desired coefficients can characterize such important characteristics as labor-power ratio, labor productivity, consumption, interpersonal interactions, etc. Also we consider the control problem: how to find the source or initial function to obtain desired statement (or people behavior) in a final fixed time.
Methods and Algorithms: Due to extremely nonlinearity we reduce the inverse and ill-posed problem solution to the optimization problem. We apply the gradient method of minimizing the cost functional. A gradient of the functionals were obtained by solving the corresponding conjugate problems [1, 2].
Conclusion: The examples of ill-posedness were constructed. We also mention the theoretical and numerical results for considered problems. Numerical results are presented.
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