Analysis of Burgers Model on Reisnerr-Nordström Spacetime by Finite Volume Approximations

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We study the relativistic Burgers model on a Reissner-Nordström spacetime geometry via finite volume approximation techniques. We observe shock and rarefaction wave propagations as a result of numerical experiments. Moreover, using the fact that the model of interest accepts static solutions, we observed numerically that the constructed finite volume schemes converge to the static solutions if the initial data is chosen as a piece-wise smooth function of these static solutions.

Consistent Discrete-Analytical Schemes for the Solution of the Inverse Source Problems for Atmospheric Chemistry Models with Image-Type Measurement Data

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The inverse source problems for nonlinear chemical transformation models with image-type measurement data are considered. These inverse problems arise when atmospheric composition monitoring data obtained as time series, vertical profiles or satellite images are assimilated in the forecast models. The use of the sensitivity operators, constructed of the set of adjoint problem solutions, allows transforming the inverse problems initially stated as the systems of nonlinear ODE or PDE to a family of operator equations depending on the given set of orthogonal functions in the space of measurement results. The operator equation can be solved with the relevant methods for nonlinear ill-posed operator equations (e.g. the methods based on the truncated SVD or Newton-type methods).

For numerical solution, the discrete-analytical schemes for transport and transformation processes are applied. The schemes are constructed with the use of the locally-adjoint problems. Multidimensional problems are treated according to the splitting technique with respect to spatial dimensions and physical processes. The accuracy of the sensitivity operator calculation is assured by the consistency of the numerical schemes for the direct and adjoin problems in the sense of Lagrange-type identities. The results of the numerical experiments are presented.

The purpose of the paper is to present the developed consistent original numerical schemes for the solution of the inverse problems as well as the results of their application.