Second International Conference "Mathematics Days in Sofia"
July 10–14, 2017, Sofia, Bulgaria

Splitting Schemes for Unsteady Problems Involving the Grad-div Operator

Peter Minev[1], Petr N. Vabishchevich[2]

[1]*Mathematical and Statistical Sciences, 677 Central Academic Building*
University of Alberta, Edmonton, Alberta, Canada
minev@ualberta.ca

[2]*Nuclear Safety Institute, Russian Academy of Sciences*
52, B. Tulskaya, Moscow, Russia
Peoples' Friendship University of Russia (RUDN University)
6, Miklukho-Maklaya St, Moscow, Russia
vabishchevich@gmail.com

Keywords: Splitting schemes, grad-div operator, difference scheme, stability

In this talk we consider various splitting schemes for unsteady problems containing the grad-div operator. The fully implicit discretization of such problems would yield at each time step a linear problem that couples all components of the solution vector. We will discuss various possibilities to decouple the equations for the different components that result in unconditionally stable schemes. If the spatial discretization uses Cartesian grids, the resulting schemes are Locally One Dimensional (LOD). The stability analysis of these schemes is based on the general stability theory of additive operator-difference schemes developed by Samarskii and his collaborators. The results of the theoretical analysis are illustrated on a 2D numerical example with a smooth manufactured solution.

Acknowledgements. This work was supported by the Russian Foundation for Basic Research (projects 14-01-00785), by a Discovery grant of the Natural Sciences and Engineering Research Council of Canada, and by a grant # 55484-ND9 of the Petroleum Research Fund of the American Chemical Society.