Lobachevskii Journal of Mathematics 2002 vol.10, pages 27-44

On the parallel domain decomposition algorithms for time-dependent problems

Lapin A., Pieskä J.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Several new finite-difference schemes for a nonlinear convection-diffusion problem are constructed and numerically studied. These schemes are constructed on the basis of non-overlapping domain decomposition and predictor-corrector approach. Our study was motivated by the article [8], where so-called EPIC (explicit predictor-implicit corrector) method have been proposed for a linear one-dimensional problem and founded to be stable and scalable when solving on big number of processors. We construct the predictor-corrector schemes for a nonlinear problem, which serves as a mathematical model for the continuous casting problem (see [1], [2], [4], [5], where implicit and characteristic grid approximations of the continuous casting problem have been theoretically and experimentally studied). We use different non-overlapping decomposition of a domain, with cross-points and angles, schemes with grid refinement in time in some subdomains. All proposed algorithms are extensively numerically tested and are founded stable and accurate under natural assumptions for time and space grid steps. Also, the parallel algorithms scales well as the number of processors increases.