Multiplicative Schwarz Method for Asynchronous Temporal Integration of Governing Equations for Transport Processes in Porous Media

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Abstract

The transport processes in porous media are in general governed by quasilinear convection-diffusion-reaction equation – a non-symmetric operator. The moving front is a very typical problem which is solved in this modeling practice. It turns out that the numerical difficulties related to abrupt changes of the solution have time dependent locations in spatial domain depending on the position of the moving wetting front.

Subcycling algorithms enabling different temporal discretization on either elements or subdomains have been extensively studied since 1970s. The problems with moving wetting front were already in our previous works efficiently resolved with time adaptive domain decomposition. In this contribution the subcycling algorithm is combined with Schwarz overlapping domain decomposition on time dependent subdomain split. Implementation details will be presented in this contribution together with a simple benchmark problem were we tested our newly implemented algorithm of adaptive domain decomposition together with multi-time-step temporal integration.

References

1. Michal Kuraz and Petr Mayer and Pavel Pech. Solving the nonlinear and nonstationary Richards equation with two-level adaptive domain decomposition (dd-adaptivity). Applied Mathematics and Computation Volume 267, 15 September 2015, Pages 207-222.