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INMOST SOFTWARE PLATFORM BASED DEVELOPMENT OF PARALLEL NUMERICAL MODELS ON GENERAL MESHES

Yu.V. Vassilevski[1], I.V. Kapyrin[1,2], I.N. Konshin[1,2]
[1]*Institute of Numerical Mathematics of RAS*
[2]*Nuclear Safety Institute of RAS*
igor.konshin@gmail.com

A report presents an experience of creation of parallel MPI-platform and graphical environment for developing parallel numerical models on general meshes. Technological platform INMOST (Integrated Numerical Modelling and Object-oriented Supercomputing Technologies) [1,2] is a tool for supercomputer simulations characterized by a maximum generality of supported computational meshes, distributed data structure flexibility and costeffectiveness, cross platform portability, as well as graphical environment for interactive user interface.

INMOST supports basic operations on mesh elements (vertices, edges, faces, and cells), their connectivity, operations on a set of elements, and tag tools to fit the data to a mesh element. The high level distributed mesh operations such as the data exchange for nearest fictitious elements, mesh data redistribution and balancing can also be used. The problem specific discretization module can exploit a special tool to form and solve the constructed linear system by PETSc, Trilinos, or internal linear solvers without taking into account the specificity of the interface for each solver.

The INMOST ideas for developing of the computational code with interactive user interface are demonstrated using the GeRa code, which is oriented on long-term groundwater flow and transport of radionuclides in geological media numerical simulation. GeRa includes modules for geostatistical modelling, grid generation and several types of discretizations for groundwater flow and transport problems. GeRa allows to perform parallel computations directly from the interface. Advanced graphical tools for visualization and verification of computational results are also included. Some results of numerical modelling experiments are presented as well.

References:

1. Yu.Vassilevski, I.Konshin, G.Kopytov, K.Terekhov, INMOST - a software platform and a graphical environment for development of parallel numerical models on general meshes. Moscow State Univ., Moscow (2013).
2. INMOST: a toolkit for distributed mathematical modeling. http://www.inmost.org (2015).