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Performance Evaluation of different time schemes for a Nonlinear diffusion equation on multi-core and many core platforms

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GPU architectures are characterized by the abundant computing capacity in relation to memory bandwich. This makes them very good for solving problems temporaly explicit and with compact spatial discretizations. Most works using GPU focuses on the parallelization of solvers of linear equations generated by the numerical methods. However, to obtain a good performance in numerical applications using GPU it is crucial to work preferably in codes based entirely on GPU. In this work we solve a 3D nonlinear diffusion equation, using finite volume method in cartesian meshes. Two different time schemes are compared, explicit and implicit, considering for the latter, the Newton method and Conjugate Gradient solver for the system of equations. An evaluation is performed in CPU and GPU of each scheme using different metrics to measure performance, accuracy, calculation speed and mesh size. To evaluate the convergence propierties of the different schemes in relation to spatial and temporal discretization, an arbitrary analytical solution is proposed, which satisfies the differential equation by chossing a source term chosen based on it.