Scalable Preconditioners for Transient Navier-Stokes Equations in Hemodynamics Simulations

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We are interested in the resolution of transient Navier-Stokes equations on large scale parallel architectures. For this reason, we are developing preconditioners for the linear system associated to the linearized problem. Weak and strong scalabilities are not the only measures for the parallel performances. In fact, the number of iterations to solve the linear system shall not increase with increasing number of parallel tasks. This can be achieved by devising specific scalable preconditioners.

We present a family of Pressure-Convection-Diffusion (PCD) preconditioners and their parallel performances. We also reformulate the preconditioned linear system in order to lower the condition number of the system. We then compare the scalability of the presented methods. The implementation is done with LifeV (http://www.lifev.org), a finite element library for High Performance Computing (HPC) based on Trilinos (http://trilinos.sandia.gov). All the methods are illustrated using simulations relevant to hemodynamics.

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