Evaluating Distributed GPU Preconditioners for Fluid Flow Simulations of the Human Nose

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Computational fluid dynamics (CFD) is an important tool to predict complex fluid flows. However, its application, for example to support pre-surgical planning in the context of nasal breathing difficulties (NBD), is currently constrained by the computational costs arising from resolving the necessary details of the inner nose geometry. In this work, we investigate the strategy to offload the computationally most expensive parts of the CFD simulations, namely the solution of the Poisson type pressure equation, to dedicated general purpose GPUs, spread across multiple compute nodes. To facilitate convergence of the employed Krylov solvers, Schwarz preconditioning in combination with several inner solvers, such as block Jacobi, ISAI or Multigrid are investigated.

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