Three-dimensional Direct Numerical Simulation of Flow Problems with Electromagnetic Control on Parallel Systems

O. Posdziech, R. Grundmann, S. Seidl and W.E. Nagel

Delft, August 1999

Abstract

Direct Numerical Simulation is used to study the impact of electromagnetic forces on ows with low electrical conductivity. The numerical solution of the governing equations requires a maximum on computational power.

Parallel systems with a large number of processing elements are predestined to realize extensive parameter studies in a justiable time. As this application consumes a signicant part of the high performance computing capacity at Dresden University of Technology, it is obvious to analyze the parallel performance to reveal possible improvements in terms of MFLOPS and scalability.

We present the parallelization of a spectral element code for an effcient solving of the 3D Navier-Stokes equations by means of the message passing system MPI. Based on VAMPIR, we have analyzed computation/communication patterns, performance and scalability behavior.

Finally, the paper describes the analysis process and the applied optimization techniques.