IMPROVEMENT OF PARALLEL PERFORMANCES OF MIOMA CODE

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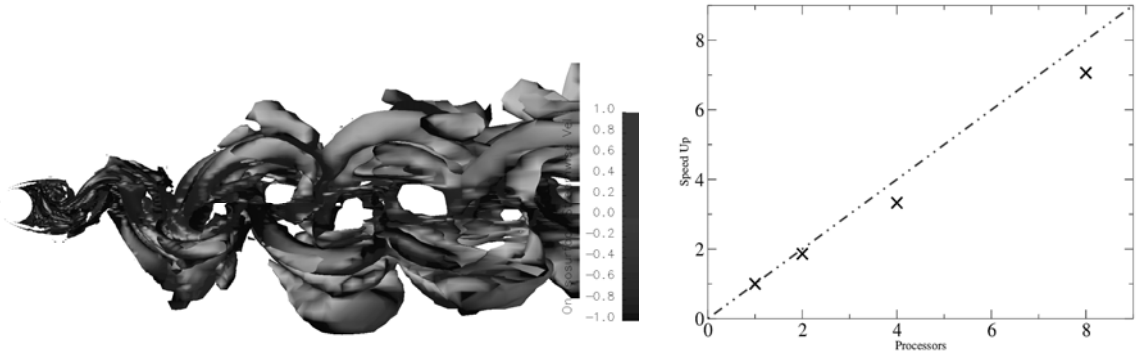
MiOma is the new parallel LES code developed in the VKI EA department, result of Giammanco's PhD studies. It is a fully cartesian solver for incompressible flows. The code, following the VKI code legacy, is based on the PETSc library for the large sparse linear systems. Based on the MPI standards, it provides utilities for parallel data management. This framework has been operational for 3 years and now, while some fulfillments have been enforced on it. After this period, a release of a its new version became pressing, in order to update its key software components and clean it out of possible misbehaviors and programming errors meanwhile included.

Firstly, the core solver of *MiOma* was updated for using the newest versions of its dependencies, because at least one major revision has been released for some of them and the amount of changes to perform was quite significant. This task involved the compiling of the main blocks of the solver: PETSc, METIS, NetCDF, and in particular, introducing the last cornerstone of the NetCDF library, version 4.0, that allows parallel read and write, previously impossible with the old stable version 3.6.1. So, it was necessary to revisit the whole tool-chain of the solver and compile it on the new basis Linux Distribution for the current private and public machines, Fedora Core 6; a compatible version with the new 64bit machines available in the cluster was also built. In this frame, there was also attempted to solve the remaining problems concerning the parallel execution and performances of *MiOma*. Indeed, some programming errors, included inside the code during the last two years of developments, were found. In particular, two majors bugs were noted in the implementation of the WALE subgrid model and the computation of the body forces. These two modules were deeply analysed and fixed the programming errors, rebuilding partially or completely their operations. A memory leak, which hindered long simulations, was also discovered and cleaned out.

A new version of *MiOma* has been finally released, updated with the newest software dependency versions and cleaned of bugs. The infinite cylinder, which occurred as a interesting and complete test case for the validation of the code, has been run and its results compared with literature. A interesting and attentive analysis of the impact of the grid resolution and the SGS coefficient was performed, through this case and thanks also to the implementation of a new grid generator. From that, some remarks about the used different settings were carried out. Finally also the parallel performances of the new released version of *MiOma* code were assessed, in order to use them as reference parallel capabilities for future improvements
and updates.



(1a) *(1b)*

Figure 1a: Flow past a circular cylinder at Reynolds 3900
Figure 1b: Speed Up of parallel performances of the new released version of MiOma code