**Multiscale & Multiphysics Modeling and Simulation of Complex Fluid Flows**

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Aim: To develop Computation with Federated Resources of Large Scale Turbulent Fluid Flows using an AI adjusted Thermodynamic Model and Comparative Analysis with Reference DNS and LES Models.

Scientific objectives:

* Proof of concept of the impact of a novel, AI adjusted, thermodynamics-based LES model for large scale turbulent fluid flows;
* Evaluation of the turbulence quantities in terms of length scales, time scales, Leonard stresses, entropy generation history, applied to geometries suitable for the proposed computational strategies;
* Comparative analysis of the obtained results by validating the new model against the reference DNS and some commercial LES models,
* Forecasting the requirements on the experimental measurements for the validation of the LES model and of the computational algorithms;
* Definition of possible new approaches to be used for the rapid prototyping in realistic, large scale turbulent fluid flows.

Computing objectives:

* Testing and validation of the computational strategies by using DNS-generated turbulent fluid flow fields;
* Extraction of accurate dynamic estimates of the computational resources at different phases of compiling, running and validating the code;
* Strategies for the evaluation of the availability of processing and storage resources and concurrent CPU approaches for accessing the required resources, in each phase of the project;
* Comparative analysis of the required processing and storage resources for the new model and the reference DNS and LES models,
* Exploring opportunities for an integrated interaction of the scientific coordination team and the system engineers operating the federated infrastructures for computation.
* Development of an Artificial Intelligence approach for solving large scale turbulent fluid flows by the integration of the new model into a library of LES models

At present, the research team has a computation infrastructure including a small cloud with 29 processing nodes, 29.1 GB RAM, 1.4 TB storage. The local infrastructure is connected to the national GRID for scientific computation and education ROeduNET.

Taking into account the very low scale of the computation infrastructure, there are no additional management and administration services.

The OUC team is interested on the following topics:

1. How to access substantial CPU time on a highly parallel cluster or supercomputer?
2. How to obtain assistance in compiling and running the novel LES code on a set of 3-D representative geometries?
3. How to have access to the DNS and LES results run on the same set of geometries. Needed to extract turbulence statistics, local stresses, velocity and pressure maps?
4. Post processing facilities for extended data representation applications (including graphics).