12th International ERCOFTAC
Symposium on Engineering Turbulence Modelling and Measurements

26–28 September 2018, Montpellier, France

Large Eddy Simulations and High-Order methods for the prediction of Turbomachinery Flows

L. Gicquel*, F. Duchaine†, J. Dombard‡ and J.-F. Boussuge¥
* CERFACS, lgicquel@cerfacs.fr
†CERFACS, duchaine@cerfacs.fr
‡CERFACS, dombard@cerfacs.fr
¥CERFACS, boussuge@cerfacs.fr

Keywords: *LES, high-order, turbomachinery flows*

1. Context

Turbomachinery flows and more generally flows around profiles in static or rotating conditions are at the root of many fluid dynamics fundamental problems as well as at the heart of many industrial applications. Their understanding and accurate prediction with conventional CFD modeling approaches are however continuously challenged due to the increased pressure coming from the business market to produce quieter, more efficient and reliable devices that also need to be produced faster and cheaper. Logically and just like other fields of applications and research [1,2], researchers have identified Large Eddy Simulation as a potential contributor to improve our understanding and modeling capacities of such devices and fundamental flow problems [3,4]. The path to be followed to construct such new CFD tool to treat such complex flows remains however not clear and fundamental issues need to be investigated while establishing a state-of-the-art of numerics and modeling capabilities in this specific and wide context of application [5,6]. In that respect, the present mini-symposium proposes to gather experts of the fields to provide a vision to the community of existing actions either dealing with high-order numerics or LES whenever applied to such systems.

2. Content

In terms of content, the mini-symposium will bring experts in numerics involved in the developments of high-performance high-order solvers to illustrate current trends while establishing present achievements of such codes to address turbomachinery applications. As a complement to this fundamental issue of numerics and LES, the panel of speakers will

involve industrials of the context as well as HPC frontier users to expose needs and state-of-the-art of high-end applications. Modeling (being at the heart of such complex flows) will also have to be addressed in conjunction with current evolutions of numerical solvers and end-applications of interest to the community. The objective of the discussions is to provide key elements while identifying the modeling difficulties present in such flows that are high Reynolds, transitional and with relaminarization while being at the same time governed by complex three dimensional and unsteady large scale features.

To do so, the following persons are identified as potential contributors:

- Koen Hillewaert from CenAero Belgium
- Peter Vincent from Imperial College
- Jerome de Laborderie from SAFRAN Aero-Engines
- Jerome Dombard from CERFACS
- Paul Tucker from University of Cambridge
- Richard Sandberg from University of Melbourne
- Vittorio Michelassi GE Oil & Gas

REFERENCES

[1] T. Poinsot and D. Veynante, Theoretical and Numerical Combustion, 3rd. Edition, 2011.
[2] L.Y.M. Gicquel, G. Staffelbach and T. Poinsot, Large Eddy Simulations of gaseous flames in gas turbine combustion chambers, Progress in Energy and Combustion Science, Vol. 38, 6, 782-817, 2012.
[3] P. G. Tucker, Computation of unsteady turbomachinery flows: Part I Progress and challenges, Progress in Aerospace Sciences, Vol. 41, 7, 522-545, 2011.
[4] P. G. Tucker, Computation of unsteady turbomachinery flows: Part II LES and hybrids, Progress in Aerospace Sciences, Vol. 41, 7, 546-569, 2011.
[5] P. G. Tucker, Advanced Computational Fluid and Aerodynamics, Cambridge Aerospace Series, Cambridge University Press, 2016.
[6] N. Gourdain, F. Sicot, F. Duchaine and L. Gicquel, Large Eddy Simulations of flows in industrial compressors: a path from 2015 to 2035, Philosophical Transaction A., Vol. 372, 20130323, 2014.