ANR Project NORMA

T6-D2 : Organization of a workshop on NORMA test cases open to partners

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The INRIA and Montpellier partners organized and animated a mini-symposium entitled «Scale resolving simulation of massively separated flows and rotating machines » during the 22nd IACM Computational Fluids Conference – CFC 2023, 25-28 April 2023, Cannes. The associated abstract is given further below (on third page).

During this mini-symposium, the work carried out by the two French partners, INRIA and the University of Montpellier, as well as the Russian partner, Keldysh institute of Moscow, in the fields of hybrid turbulence models, mesh adaptation and rotating machines, were presented:

- F. Miralles, B. Sauvage, S. Wornom, B. Koobus, A. Dervieux, « *Assessment of turbulence hybrid models with transition modeling for the simulation of massively separated flows* », 22nd IACM Computational Fluids Conference, CFC 2023, 25-28 April, Cannes, France.

- B. Sauvage, F. Miralles, S. Wornom, B. Koobus, F. Alauzet, A. Dervieux, « *Assessment of mesh adaptation algorithms for LES and DES simulation of detached flows* », 22nd IACM Computational Fluids Conference, CFC 2023, 25-28 April, Cannes, France.

- L. Abalakin, V. Bobkov, V. Tsvetkova, B. Sauvage, F. Miralles, T. Kozubskaya, S. Wornom, B. Koobus, A. Dervieux, *"Towards efficient simulation of turbulent flows and noise in rotating machines"*, 22nd IACM Computational Fluids Conference, CFC 2023, 25-28 April, Cannes, France.

The test cases considered are the circular cylinder, the Caradonna-Tung two-blade rotor with and without Robin fuselage.

The other presentations of this mini-symposium were as follows :

-*"Towards Resolving Natural Shock Oscillation and Mitigation of Altitude Excitation in a Transonic Fan"*, Philipp L. Nel*, Patrick Grothe†, Marius Swoboda†, Julien Weiss†† and Sergio Pirozzoli†††
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-*"Minimum-Dissipation Model for Large Eddy Simulation using OpenFOAM"*, Jing Sun*

Roel Verstappen*
*Computational and Numerical Mathematics–Bernoulli Institute
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Nijenborgh 9, 9747 AG Groningen, The Netherlands

-*"Influence of engine exhaust on wing underside flow for a passenger aircraft"*,

Jan Mueller*, Kazuhisa Chiba* and Yoshinori Oba†
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Communications 1-5-1, Chofugaoka, Chofu, Tokyo 182-8585, Japan
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-*"Scale-Resolving Simulation of Flow Separation with a Sensor-Based Eddy Viscosity Model"*, Eike Tangermann*, Markus Klein*

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Werner-Heisenberg-Weg 39, 85577 Neubiberg, Germany

-*"Laminar-Turbulent Transition in a Separation Bubble with Wall Disturbance and Free-stream Turbulence"*, Sonalika Srivastava†and S Sarkar†

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Scale-resolving simulation of massively separated flows and rotating machines, proposition of mini-symposium for the IACM 22ⁿᵈ Computational Fluids Conference CFC 2023

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ABSTRACT

Scale-resolving simulation of massively separated flows relies frequently on extensions of statistical turbulence modeling with the introduction of LES-type scale-resolving capacities. The approach includes DES methods, hybrid RANS-LES methods, PANS...We refer to the review [1]. It is more CPU expensive but yields more accurate predictions in many configurations. Further, these methods enable to predict noise emission by adapting the conditions of the computation and coupling with acoustic models.

Still large research efforts are necessary for improving *accuracy* and *efficiency* of this family of methods.

The mini-symposium will discuss advances in these two directions with an emphasis on the perspective of a better simulation of flows in *rotating machines*. Rotating machines involve rotating devices like turbo-machines, wind turbines, future aerial taxis,...

Therefore the mini-symposium would cover works on new DES and hybrid models, and new numerical approaches, including:

- methods for taking into account the rotation,

- higher order methods and

- mesh adaptation methods,

 and proposing applications, with emphasis on rotating machines.

REFERENCES

[1]   J. Froehlich, D. von Terzi, LES/RANS methods for the simulation of turbulent flows, Progress in Aerospace Sciences 44 (2008) 349–377.

[2]   F. Miralles, B. Sauvage, A. Duben, V. Bobkov, T. Kozubskaya, S. Wornom, B. Koobus, A. Dervieux, Simulation of massively separated flows and rotating machine flows using hybrid models, The 8th European Congress on Computational Methods in Applied Sciences and Engineering, ECCOMAS Congress 2022, 5-9 June, Oslo, Norway.