6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

ERROR INVESTIGATION IN COUPLED SIMULATIONS

Neda Ebrahimi Pour[1], Sabine Roller[2]

[1]University Siegen, Adolf-Reichwein Str. 2, 57076 Siegen, neda.epour@uni-siegen.de
[2] University Siegen, Adolf-Reichwein Str. 2, 57076 Siegen, sabine.roller@uni-siegen.de

Key Words: *coupled simulation, multi-scale, discontinuous Galerkin*

In the last decade the investigation of fluid-acoustic interactions gained more attention, since simulation of such interactions allow a better understanding of the occurring phenomena and the improvement of technical devices in the engineering field. Because of different scales and physics, which have to be resolved up to the smallest scale, the simulation of the whole problem in a single domain is still not feasible on today's supercomputers.

In order to overcome this problem, we make use of partitioned coupling, where we split the whole domain into smaller areas, which can then be discretized independently and coupled at the boundaries via coupling approaches.

For the coupling we use an inhouse approach called APESmate and an open source approach named preCICE. APESmate is integrated in our APES framework, which has knowledge about the numerical schemes inside the coupling domain. Hence it is able to evaluate high order polynomials of the underlying scheme for the data-exchange. The coupling library preCICE is a more general approach, where only point values (and in some cases neighborhood information) have to be known at the coupling surface, but no further details about the scheme, discretization method or mesh. Hence for the data-exchange between the domains, preCICE has to interpolate the requested values using interpolation methods.

In this work we will mainly concentrate on the investigation of the different interpolation methods, where we chose the best-suited method with the smallest L2error for our main simulations. For the simulations we consider an obstacle inside the domain, which is solved, using the Navier-Stokes equations. Away from the object we simplify our equations using the Euler equations or linearized Euler equations.

REFERENCES

[1] H. -J. Bungartz, J. Benk, B. Gatzhammer, M. Mehl and T. Neckel, Partitioned Simulation of Fluid-Structure Interaction on Cartesian Grids. In H. -J.Bungartz, M. Mehl and M.Schäfer, editors, Fluid-Structure Interaction – Modelling, Simulation, Optimisation, Part II, pages 255-284,Springer Berlin, Heidelberg, 2010.

[2] V. Krupp, K. Masilamani, H. Klimach, S. Roller, Efficient coupling of fluid and acoustic interaction on massive parallel systems, In Resch, Michael and Bez, Wolfgang and Focht, Erich and Kobaysahi, Hiroaki and Patel, Nisarg, Sustained Simulation Performance 2016, Springer, 2016