No.1 2019

PDC Center for High Performance Computing

Business Unit Newsflash

Upcoming Calls and Events

PDC Center for High Performance Computing

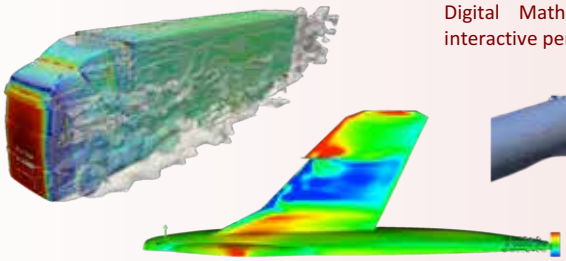
Welcome to the second
PDC INDUSTRY DAY!

If you would like to discuss the HPC needs of your company and hear about the wide range of HPC services and expertise that your business can take advantage of, then you and your colleagues are invited to join us for this inspiring event!

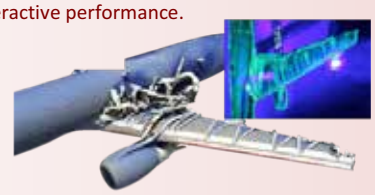
https://www.pdc.kth.se/about/events/pdc-industry-day-2019-1.912939

Date: 2019-09-19
Time: 10:00 AM
Place: Fantum, KTH Main Campus
Address: Lindstedtsvägen 24, 5th floor, 114 28 Stockholm

Rumblestrip: CFD simulation showing surface pressure and flow structures around a truck with an optimally positioned roof air deflector.



Icarus Digital Math: World first unique breakthrough: predicting aerodynamic designs (stall), solving NASA grand challenge. Digital Math Open Source FEniCS with interactive performance.



Airinnova AB: Saab J-29 Tunnan aircraft wing-body configuration with F-wing ("saw-tooth" or fence), skin-friction visualization from RANS simulation with S-A model, Mach = 0.5, AoA = 14. The fence makes the flow remain attached at the outboard of the wing, leading to the conclusion that the F-wing design with the fence can maintain the aileron effectiveness.

Next Cut-Off Dates

PRACE Preparatory Access Type-D: 2 September & 2 December 2019 – 11:00 AM CEST
HPCE3 Calls: **Call #9** - 19 September 2019 at 23:59, **Call #10** - 20 November 2019 at 23:59
PRACE 10th SHAPE call: expected to be opened in September 2019

Rumblestrip Collaborates with PDC

by Andreas Persson, Rumblestrip

With increasing fuel prices and environmental awareness, it is very clear that the heavy transport industry needs to continuously improve the fuel efficiency of its trucks. Aerodynamic drag is one of the biggest contributors to total fuel consumption, so manufacturers spend many millions each year on developing the aerodynamic properties of their vehicles, which must live up to ever tighter regulations regarding emissions.

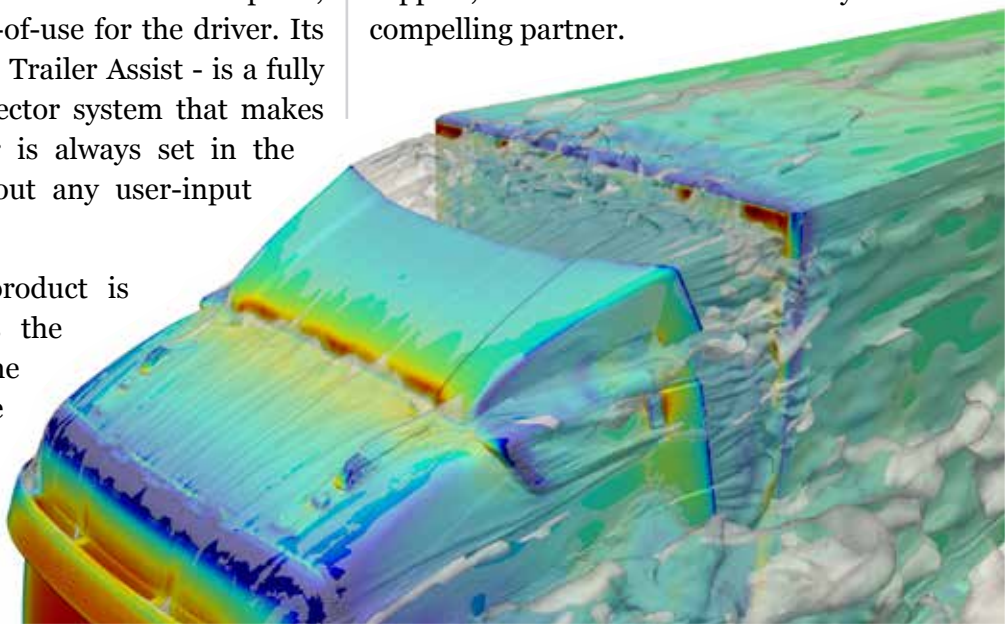
The roof air deflector, which sits on top of the cab roof, is the single most important component for reducing air resistance – provided it is adjusted correctly with regard to the trailer height and gap. Sadly, many trucks, in reality, drive around with incorrectly adjusted roof deflectors. The result is that haulers on average unnecessarily waste several percent of their fuel. In the worst cases, the penalty can be in excess of 10 %. This is significant in an industry where every fraction of a percent in reduced fuel consumption is chased by the engineers!

Rumblestrip was founded in 2016 with a clear focus on developing more intelligent solutions, which make sure that the trucks on our roads achieve the lowest possible fuel consumption, while maintaining ease-of-use for the driver. Its first product - Ecosense Trailer Assist - is a fully automatic roof air deflector system that makes sure that the deflector is always set in the optimal position, without any user-input being necessary.

The core of the product is software that analyses the configuration of the truck, as well as the aerodynamic flow field, and positions the deflector optimally at all times. To fully understand the behaviour of the flow field around different types of trucks and deflector settings, a large number of computational fluid dynamics (CFD) simulations are performed on the Beskow cluster at PDC.

A key goal of these simulations is to understand how the forces on the deflector vary with its angle, and how these relate to the drag value of the vehicle. Rumblestrip uses an almost fully automated OpenFOAM process, from meshing on the computation nodes (snappyHexMesh) to postprocessing on Beskow or Tegner. A typical mesh size is in the region of 30-50 million cells, and a full Reynolds-averaged Navier-Stokes (RANS) simulation can be completed in only 4-5 hours on 128 cores.

Having access to the PDC supercomputers is a great asset for a young start-up company like Rumblestrip. Primarily, it makes virtually infinite scaling possible if there is a tight deadline. Compared to other high performance computing (HPC) solutions that Rumblestrip has tested, the main advantages of working with PDC are the raw performance, scalability, and excellent support, all of which make PDC a very compelling partner.



Above: CFD simulation showing surface pressure and flow structures around an optimally positioned roof air deflector

HPCE3 Second SME Workshop

As you may know from the previous edition of the PDC Business Unit Newsflash, the HPC Europa 3 project committed to organizing three SME workshops in order to increase awareness of the advantages of HPC amongst SMEs.

The second SME workshop, "Can HPC help my SME grow", was held at the Doria Grand Hotel in Milan on the 23rd of May 2019. The aim of the workshop was to present the state-of-the-art of Industry 4.0 technologies together with methods and techniques that might be used to transform an existing manufacturing plant into an Industry 4.0 compliant plant.

There were 50 participants at the very successful workshop and companies like Bi-REX, E4, MADE, Moxoff, and RED Fluid Dynamics presented their success stories. The SME participants learned about state of the art technologies and how to take advantage of HPC, were introduced to SMEs that are successful in an industry dominated by large companies, and got in touch with the experts in industry, research, and academia.

PRACE SHAPE 9th Call

The PRACE SHAPE Programme helps SMEs (particularly HPC "first-timers") to take advantage of what HPC can offer, for example:

- enabling the development of new products,
- reducing time-to-market and R&D costs, and
- increasing the quality of services and products.

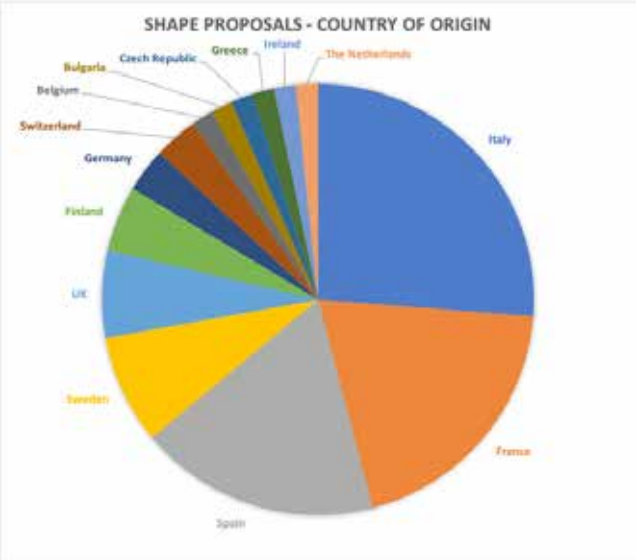
The SHAPE Programme also helps SMEs to overcome barriers to HPC adoption, such as:

- cost of HPC operation,
- lack of expertise in HPC,
- lack of HPC resources, and
- potential risks.

The regular SHAPE calls for applications are judged on the strength of the business case that is presented, its achievability, the level of commitment from the SME and the innovativeness of the proposal, as well as the benefits of the likely social and economic impact for society.

SMEs that are successful are given 2-6 project months of a PRACE expert's time, and machine time on an appropriate HPC system. In return, the SME supplies domain expertise and in-kind effort, as well as producing a white paper publicising the results of the project.

The first SHAPE call was run as a pilot in 2013 and, since then, 45 European SMEs have been assisted with using HPC technology and techniques. The 45 projects have covered a broad range of application areas and were from 11 different countries.



Although Sweden is a relatively small country, Swedish SMEs have demonstrated their willingness to take advantage of these opportunities and we would like to encourage all SMEs to explore this path to HPC as well. The 9th SHAPE Call closed on 31st of May 2019 but we expect the 10th Call to open in September 2019.

If you are interested in applying, please contact Dr. Lilit Axner (lilit@kth.se), the PRACE coordinator for Sweden, if you have any questions or would like some assistance with the application process.

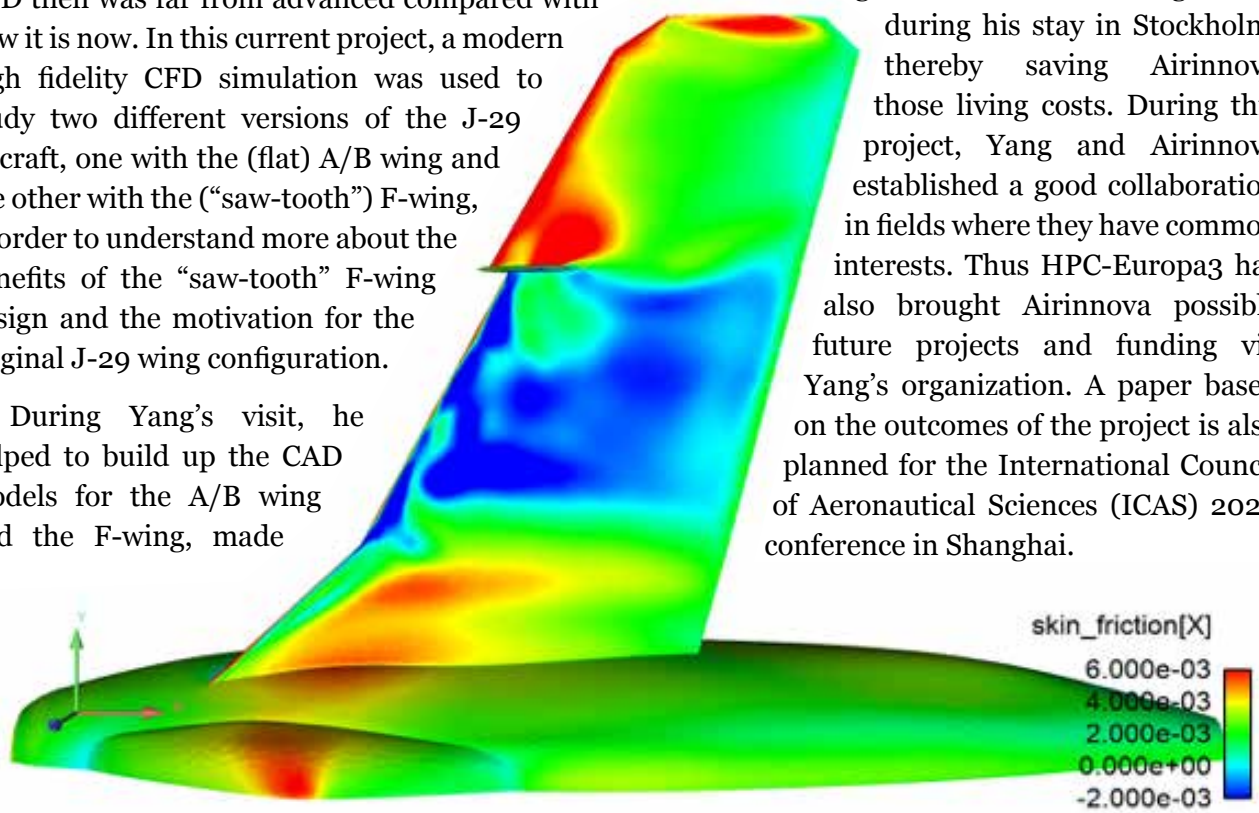
Airinnova's Second HPCE3 Visiting Researcher

This year the Airinnova company again applied to the HPCE3 project to host a visiting researcher - this time from China. Shengyi Yang, from Guizhou Minzu University, Huaxi District, Guiyang City, Guizhou Province, visited Airinnova for two months in March and April 2019 to work on a project that investigated the Swedish-designed fighter Saab 29 Tunnan plane, also known as the "Flygande tunnan". The J-29 series were some of the first fighters that were produced with a swept-back wing. Saab designed them in the 1940s using extensive amounts of wind tunnel testing. The development of computer simulation and CFD then was far from advanced compared with how it is now. In this current project, a modern high fidelity CFD simulation was used to study two different versions of the J-29 aircraft, one with the (flat) A/B wing and the other with the ("saw-tooth") F-wing, in order to understand more about the benefits of the "saw-tooth" F-wing design and the motivation for the original J-29 wing configuration.

During Yang's visit, he helped to build up the CAD models for the A/B wing and the F-wing, made the corresponding hybrid RANS meshes and ran the steady RANS simulations (Mach sweep) on Beskow for each of the wings. He also performed analyses and comparisons of the simulation results for those two types of wings.

Below: Saab J-29 Tunnan aircraft

The HPC-Europa3 project covered a significant amount of Yang's costs during his stay in Stockholm, thereby saving Airinnova those living costs. During this project, Yang and Airinnova established a good collaboration in fields where they have common interests. Thus HPC-Europa3 has also brought Airinnova possible future projects and funding via Yang's organization. A paper based on the outcomes of the project is also planned for the International Council of Aeronautical Sciences (ICAS) 2020 conference in Shanghai.



Saab J-29 wing-body configuration with F-wing, skin friction visualization from RANS simulation with S-A model, Mach = 0.5, and AoA = 14

Need help with your HPC research?
Contact business-unit@pdc.kth.se