Ansys

CASE STUDY /

Rolls-Royce Reduces the Time Required for a Coupled CFD–Structural Simulation by 80% Using Cloud Computing

"Rolls-Royce is a leader in the implementation of a new high-performance computing (HPC) cloud approach in which a structural solver is coupled with Ansys Fluent computational fluid dynamics (CFD) to provide heat flux predictions at many points on component walls of jet engines. Because of the near-linear scalability of Fluent, running the coupled fluid–structural simulation on an HPC cluster in the cloud was five times faster wall-clock time than running the problem on a local workstation."

Marius Swoboda
Head of Design Systems Engineering / Rolls-Royce Germany

Ansys

CASE STUDY

Engine manufacturers continue to increase turbine entry temperatures to improve engine efficiency. In this process, engineers must often redesign the engine's cooling and sealing systems to prevent the overheating of critical internal components. Rolls-Royce's proprietary structural simulation code relies on thermal data obtained from sensors mounted on the prototype engine, so the thermal design of a new engine cannot begin until late in the product development process, when design changes are very expensive.

/ Company Description

Rolls-Royce is a power systems company. For more than a hundred years they have been providing power for aircraft, ships and land applications. Their vision is to provide "better power for a changing world." The company is best known for aero engines that power many of the world's most advanced passenger jets, like the new Airbus A350 and the Boeing 787 Dreamliner.

Thanks to CPU 24/7 for assistance in creating this case study.

/ Challenges

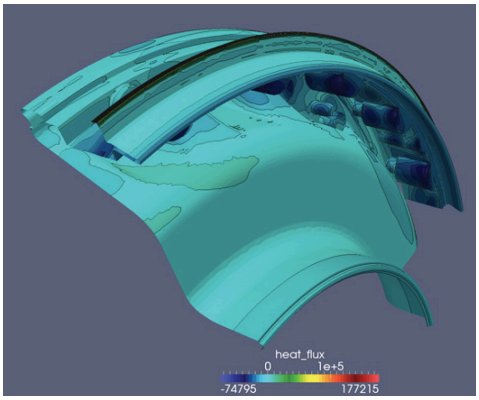
Engineers wanted to eliminate the use of thermal sensors on prototype engines by determining the heat flux with Ansys Fluent, then coupling Fluent to Rolls-Royce's proprietary structural simulation code, thereby solving structural and thermal design problems simultaneously using an iterative process. But this solution required HPC, and HPC use at Rolls-Royce was at maximum capacity.

/ Technology Used

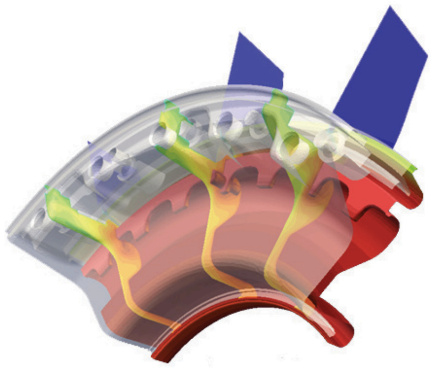
- Ansys Fluent®
- Ansys HPC Pack™
- CPU 24/7 HPC ON Demand Resources

/ Engineering Solution

- Rolls-Royce engineers decided to use CPU 24/7 GmbH & Co. KG to provide cloud-based HPC computing power on demand.
- The calculation was done in cycles in which either the structural solver or the Fluent CFD solver alternately ran and then passed data to the other when the cycle was completed.
- The CFD part of the simulation was run on 32 compute cores, while the structural part ran on only one.



Contours of heat flux, which is used as boundary condition for the structural code.



Contours of total temperature for the interstage cavity as output of the CFD calculation.

/ Benefits

- Coupled fluid–structure simulations in the HPC cloud enabled Rolls-Royce engineers to iteratively optimize the entire cooling and sealing system design in the early stages of the product development process, thus avoiding costly, expensive design revisions late in the process.
- By outsourcing the computational workload to the HPC cloud provider CPU 24/7, HPC resources were elastically provisioned and released.

ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
U.S.A.
724.746.3304
ansysinfo@ansys.com

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

Visit www.ansys.com for more information.