[Subject area: Aerodynamics]

HECTOR MAKES RECORD-BREAKING START

Early work on the new HECToR supercomputer has produced what is probably the largest 'direct numerical simulation' ever carried out in the UK.

Researchers from the University of Southampton have been using HECToR to model the behaviour of fluid flows. The work is important in understanding the patterns of flow that develop, for example, over aircraft wings or in jets.

Dr Richard Sandberg of the Aerodynamics and Flight Mechanics Research Group at Southampton explains. "We are engaged in fundamental research into airflows of engineering relevance. It is possible to derive equations of fluid motion for a variety of scenarios – but these equations are highly complex and a general analytical solution does not exist."

One phenomenon that is notoriously difficult to simulate is that of turbulence, where the pattern of the flow of fluid – in this case air – consists of eddies with a wide range of length- and time scales. To simulate these situations, the region of interest is divided into a grid of interconnected cells and the mathematical equations for each individual cell are solved for each instant in time. "You need a grid that can accommodate all the structures so it needs to have very small spacing to take account of very small eddies, but at the same time a large domain is required to capture the large motions," Dr Sandberg says.

Using HECToR the researchers have constructed the largest fluid simulation ever carried out in this country, with half a billion grid points evaluated for 60,000 time-steps. The calculations were done on 2048 computer processors.

"The simulations we were able to conduct on HECToR will provide a benchmark for future research," Dr Sandberg says. "I am confident that by performing these large simulations we will be able to explain why certain phenomena occur in fluids in real life."

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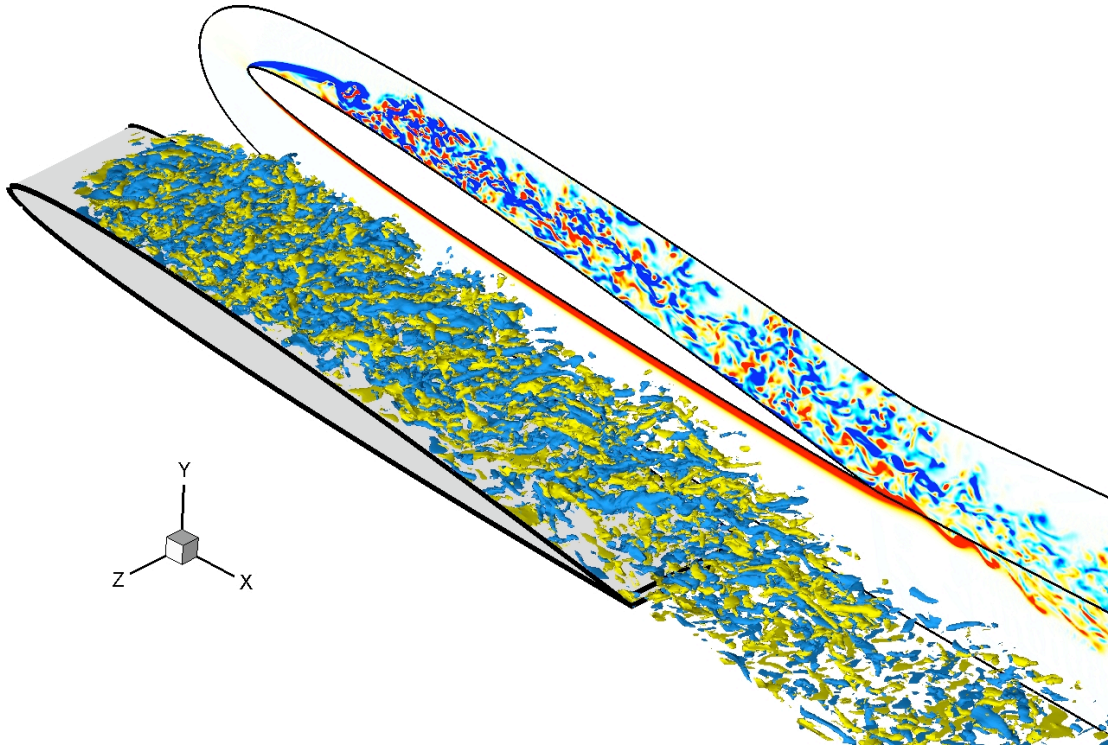

Turbulent times…computer-generated simulation of turbulent structures forming on the surface of an airfoil