Zhong-Nan Wang

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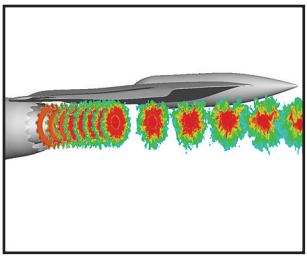
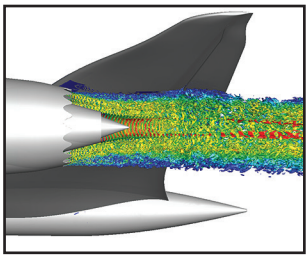
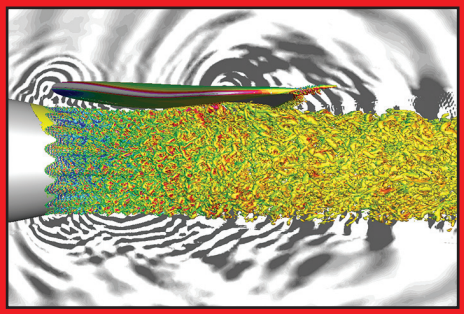
Zhong-Nan Wang is a postdoctoral researcher in the department of engineering at University of Cambridge. He is working on using HPC to simulate turbulent flows related to aeroacoustics of aeroengines. He plans to use his prize to visit two collaborators in California: Professor Tim Colonius at the California Institute of Technology, and Professor Sanjiva Lele at Stanford. These visits will strengthen their already existing collaborations.

Noise is a major concern to those who live near airports. A jet taking off can reach a noise level of 120 dB, enough to cause pain if close by. More generally, the noise of many aircraft taking off and landing per day can be a significant nuisance.







Our research is using ARCHER HPC machines to study how the noise from jet engines can be reduced. We simulate unsteady turbulent flows from a propulsive jet under a realistic wing. The method we use is able to resolve the large scale flow structures in the jet which are responsible for sound generation. This can then be used to calculate the associated noise levels.

Our research has real-world aerospace applications and has wide potential impact. Understanding the sound generation mechanism is crucial to the lower noise engine design. Data gathered from our simulations has improved understanding into how jet flows generate sound, and how the shape of the engine nacelle can be changed to improve this. This research can lead to new, environmentally friendly engines with lower noise levels.

Using ARCHER, we have performed landmark simulations of the flow around jet engines. This work has demonstrated HPC's ability to tackle complex industrial problems in a reasonable time. In the experimental engine test, the sound and flow data are usually obtained with a large level of uncertainty. However, simulation can be much more precise, eliminating the need for costly experiments. This work would not have been possible without ARCHER.

Our work provides the scientific community with a valuable resource to analyze jet engine noise. This can be used to explore the full potential of jet noise reduction approaches.