Model Order Reduction of Wind Farms

Department of Aeronautics, Imperial College London

PhD Studentship in Computational Fluid Dynamics, Data Assimilation & Control

Applications are invited for a PhD studentship in Computational Fluid Dynamics (CFD), Data Assimilation & Control within the Department of Aeronautics, Imperial College London in the turbulence simulation group under the supervision of Dr. Sylvain Laizet and Dr. Andrew Wynn.

Renewable energy is critical for reducing global carbon emissions. Investment in this sector has increased greatly as the cost of renewable technologies fall and their efficiency continues to rise. Nonetheless, the EU 2030 Wind Energy Vision calls for a technological paradigm shift: the aim is to increase power output by an order of magnitude in the next decade but with only double the number of wind turbines. Modern large-scale offshore wind farms consist of multiple turbines clustered together in well-structured formations. Clustering is an issue for wind farm operation, primarily because many downstream turbines lie in the wakes of those upstream. A wind turbine operating in a wake is an issue for two reasons. First, there is a significant reduction of power output due to the wind speed de-acceleration and, second, there is an increase of fatigue loads due to upstream wake-laden turbulence. Power losses from wake effects were recently reported to be in the order of 10–25% while fatigue-related failures were reported to be around the same level owing to a limited understanding of the offshore turbulence. To summarize, existing wind farms do not produce as much power as they should and fail too often. This aim of this PhD project is to investigate the aerodynamics of large-scale wind farms and to develop low-cost models which improve the state-of-the-art for wind turbine wake prediction. This will enable improved farm-level control strategies for increasing wind-farm power output. The project will be based on high-fidelity simulations using the open source solver WInc3d, coupled with data-driven low-order modelling approaches.

The successful candidate will be enthusiastic, self-motivated and will meet the academic requirements for enrollment for the PhD degree at Imperial College London. They will have a background in Engineering, Mathematics or a related discipline together with a strong intellect and an enthusiastic approach to research. Excellent team-working, analytical and communication skills are also essential. Applicants should have a keen interest and solid background in CFD & Control. Knowledge of Fortran and Python is preferable. Experience in High Performance Computing would be a great asset.

Funding is available for UK citizens and EU citizens who have resided in the UK for the past three years. The studentship is for 3.5 years and will provide full coverage of tuition fees and an annual tax-free stipend of approximately £17,009.

Interested applicants should send an up-to-date curriculum vitae to Dr Sylvain Laizet (s.laizet@imperial.ac.uk) address citing “PhD Studentship” in the email title. Suitable candidates will be required to complete an electronic application form, following the standard Imperial College application procedure: http://www.imperial.ac.uk/study/pg/apply/. Any queries regarding the application process should be directed to Ms Lisa Kelly by email at l.kelly@imperial.ac.uk.

Closing date for applications: until filled
Start Date: 01 October 2020

Committed to equality and valuing diversity. We are also an Athena Bronze SWAN Award winner, a Stonewall Diversity Champion and a Two Ticks Employer.