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WHAT IS NEXT FOR UNSTEADY AERODYNAMICS?

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SEBASTIAN TIMME[*] AND SIMAO MARQUES[†]

[*] School of Engineering
University of Liverpool, Liverpool, L69 3GH, UK
sebastian.timme@liverpool.ac.uk

[†] Department of Mechanical Sciences & Engineering
University of Surrey, Guildford, GU2 7XH, UK
s.marques@surrey.ac.uk

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ABSTRACT

The field of unsteady aerodynamics has witnessed significant advancements in recent years, driven by the increasing need to analyse, model and control complex flow phenomena. To overcome future challenges, the question arises: what is next for unsteady aerodynamics? To address this question, this mini-symposium will explore the latest developments in the field and shed light on the future directions and challenges, bringing together experts from academia, industry and research institutions to discuss cutting-edge approaches and emerging trends in the analysis of unsteady flows. The primary focus will be on utilizing the results of high-fidelity computational fluid dynamics (CFD) simulations and equivalent experiments to gain insights into highly unsteady flow phenomena.

In addition to high-fidelity data generation (using numerical and experimental means), we invite contributions that highlight the role of data models through machine learning (ML) / artificial intelligence (AI) in unsteady aerodynamics research. Contributions, that explore the application of ML and AI algorithms in dealing with turbulence and transition, flow control, optimization, etc., are of interest, showcasing their potential for enhancing our understanding of complex unsteady aerodynamic phenomena.

Closely related to this, reduced order modelling (ROM) techniques will be another essential aspect. ROM enables the efficient representation and simulation of complex unsteady flows, facilitating real-time analysis and design optimization. The symposium will discuss the latest developments in ROM methodologies, including operator- and data-driven modal decompositions and system identification. The integration of ROM techniques with high-fidelity CFD and data-driven models for accelerating design and analysis processes is of particular interest.

This mini-symposium will foster interdisciplinary discussions, encouraging fruitful collaborations between researchers working in different areas of unsteady aerodynamics. It will provide a platform for exchanging ideas, sharing experiences, and presenting novel research findings. By exploring the next steps in unsteady aerodynamics research, we aim to address the challenges and identify the opportunities that lie ahead, ultimately advancing the understanding of unsteady flows in various applications such as aerospace, automotive, and energy systems.