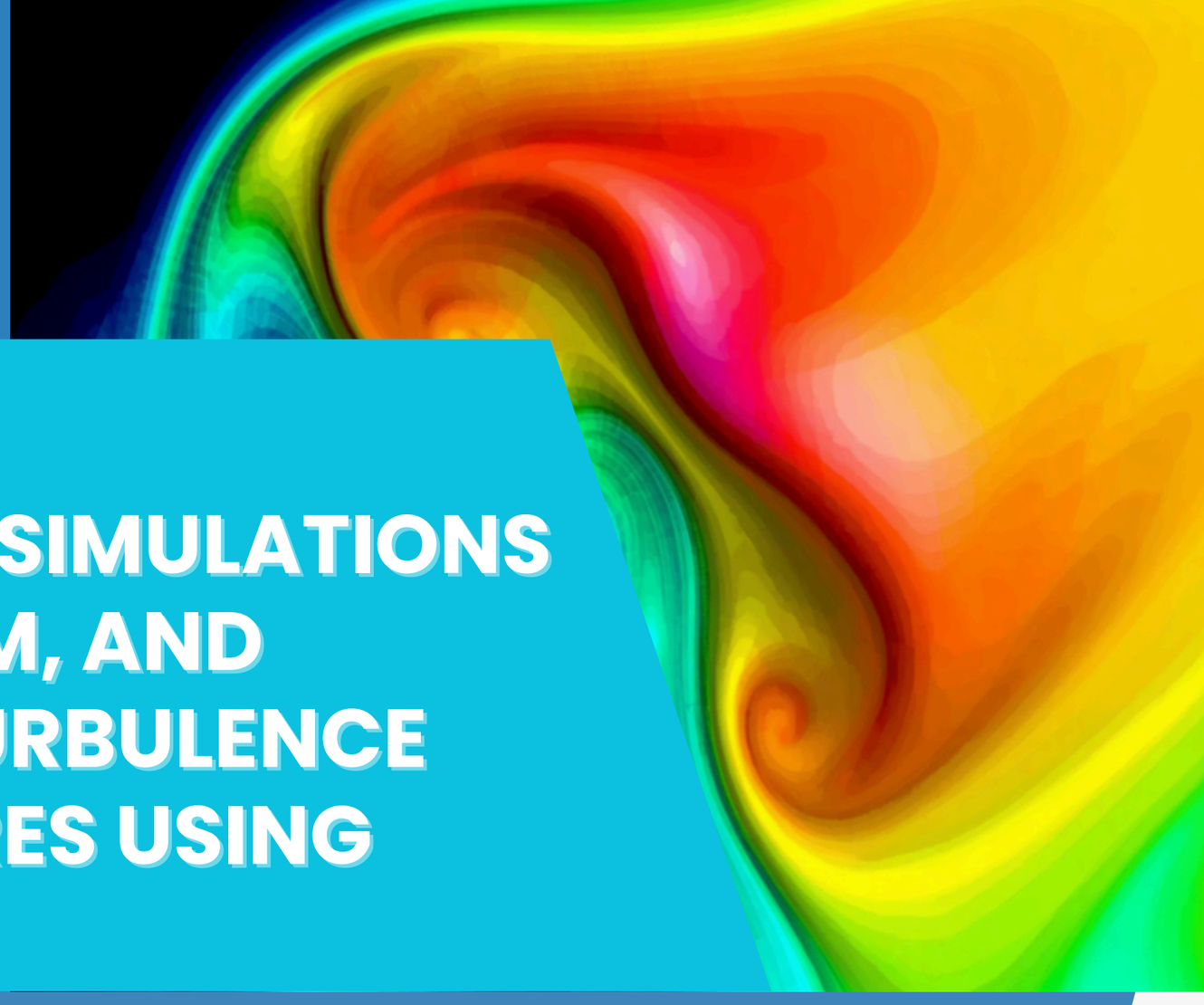
Politecnico di Torino

Dipartimento di Ingegneria Meccanica e Aerospaziale



DIMEAS SEMINAR

PUSHING HIGH-FIDELITY SIMULATIONS TOWARDS MORE REALISM, AND BUILDING CFD-READY TURBULENCE AND HEAT-FLUX CLOSURES USING MACHINE LEARNING

SPEAKER

Richard Sandberg

Professor, Department of Mechanical Engineering, University of Melbourne, Australia

Webinar online

July 3rd, 10,30 am

Sala Ferrari, II floor, DIMEAS – Politecnico di Torino

Abstract

CFD predictions are becoming increasingly important in the design of energy and propulsion products and have the potential to accelerate and reduce cost of new developments. This presentation will demonstrate that design of experiments using highly accurate first-principles based simulations are now possible at engine scale conditions and including operational aspects such as wear.
It will also show how physical insight relevant to designers can be extracted from such data sets that can be exploited for further efficiency gains. The talk will also introduce a novel machine-learning approach that can use either high-fidelity or sparse experimental data for CFD model development. A method relying on CFD-feedback during closure training is presented that ensures model consistency, i.e. that inherently produces models that perform well in the full CFD environment. Recent progress on attempts to reduce model training time will also be discussed.
This includes the integration of language-model based transfer learning into the CFD model development and surrogate model-assisted model developments.
It will be shown that closure models developed using the gene-expression programming approach, which are interpretable and easily implementable into CFD solvers, outperform traditional models both for the cases they were trained on and for cases not seen before

BIO

Prof. Richard D. Sandberg is Chair Professor of Computational Mechanics in the Department of Mechanical Engineering at the University of Melbourne. He also is the current Director of the Melbourne Energy Institute.
His main interests are in (i) high-fidelity simulation of transitional and turbulent flows to gain physical understanding of flow and noise generation mechanisms, (ii) pursuing novel machine-learning approaches to help assess and improve low-order models that can be employed in an industrial context.
He received his PhD in 2004 in Aerospace Engineering at the University of Arizona and prior to joining the University of Melbourne, he was a Professor of Fluid Dynamics and Aeroacoustics in the Aerodynamics and Flight Mechanics research group at the University of Southampton and headed the UK Turbulence Consortium. He held an Australian Research Council Future Fellowship for 2020-2024 to work onintegrating high-fidelity simulation and machine-learning based turbulence modelling. He is currently an editor for the Journal of Turbomachinery, Flow, Turbulence and Combustion and Theoretical and Computational Fluid Dynamics. He was recently elected Fellow of the Australasian Fluid Mechanics Society