

MULTISCALE METHODS FOR COUPLED CFD PROBLEMS

CELEBRATING THE 80TH ANNIVERSARY OF PROF. SERGIO IDELSOHN

JUAN M. GIMENEZ^{*}, ALESSANDRO FRANCI^{*†},
NORBERTO NIGRO[^] AND EUGENIO OÑATE^{*†}

^{*} Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE), Barcelona, Spain
jmgimenez@cimne.upc.edu

[†] Universitat Politècnica de Catalunya (UPC), Barcelona, Spain

[^] Centro de Investigación en Métodos Computacionales (CIMEC), Santa Fe, Argentina

ABSTRACT

This invited session will focus on multiscale methods in Computational Fluid Dynamics (CFD), emphasizing recent advancements in numerical techniques designed to capture complex dynamics across multiple scales. Particular attention is given to hybrid approaches combining traditional methods with data-driven and machine learning techniques, including turbulence closure modeling, reduced-order models, and surrogate approaches, to enhance flow and heat transfer simulations.

One of the central challenges is the coupling of turbulence modeling with aerodynamic, urban, and environmental flow applications. A key area of focus will be the accurate representation of boundary layer phenomena, which are critical for understanding drag, flow separation, and overall system performance, especially in coupled thermo-fluid problems.

In addition, the session will address the multiscale coupling of particulate flow dynamics in air, where upscaling approaches for modeling interactions between the carrier fluid and dispersed phases play a crucial role. Topics such as urban pollutant dispersion and particle-induced erosion will be explored, highlighting the importance of flow-particle interactions.

By covering a broad range of challenges in turbulent, thermal, and multiphase flow phenomena, and incorporating multiscale and data-driven techniques, this session aims to promote discussion on advanced numerical methods and foster cross-disciplinary collaboration in fluid dynamics. Contributions ranging from theoretical developments to applied studies are welcome, spanning a wide variety of engineering and environmental flow problems.

Organized in celebration of the 80th anniversary of Prof. Sergio Idelsohn, this session recognizes his contributions to computational mechanics and coupled numerical methods, while fostering discussion on advanced numerical approaches in fluid dynamics.