XI International Conference on Coupled Problems in Science and Engineering, COUPLED 2025
May 26-29, 2025, Villasimius, Sardinia, Italy

MULTISCALE METHODS FOR CFD PROBLEMS

JUAN M. GIMENEZ[*], SERGIO R. IDELSOHN[*]
AND EUGENIO OÑATE[*]

[*] Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE)
Edifici C1 Campus Nord UPC C/ Gran Capità, S/N, 08034, Barcelona, Spain
jmgimenez@cimne.upc.edu
sergio@cimne.upc.edu
onate@cimne.upc.edu

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, particularly turbulence, across multiple scales. The session will explore various approaches to multiscale modeling, including traditional techniques and emerging strategies such as data-driven based machine learning models, all aimed at improving the efficiency and accuracy of flow simulations.

One of the central challenges discussed will be coupling turbulence modeling with aerodynamic applications. These include wind turbines, automotive design, and the airflow prediction on urban environments. A key area of focus will be the accurate representation of boundary layer phenomena, critical for understanding drag, flow separation, and overall performance in aerodynamic systems. Applications where thermal coupling is relevant are also welcome.

In addition, the session will address the coupling of particulate flow dynamics in air. Topics such as wind turbine blade erosion, pollutant dispersion in urban environments, and particulate accumulation in ventilation systems will be explored, emphasizing the importance of accounting for particulate matter in both environmental and engineering contexts.

By covering the full spectrum of challenges related to turbulent and complex flow phenomena, and incorporating multiscale and machine learning techniques, this session aims to promote discussions on advanced numerical methods and foster cross-disciplinary collaboration in the field of fluid dynamics.