Congreso de Métodos Numéricos en Ingeniería (CMN2026)
July 1–3, 2026 – Gijón, Spain

NUMERICAL METHODS FOR FLUIDS ENGINEERING

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ABSTRACT

The session *Numerical Methods for Fluids Engineering* focuses on recent advances in computational strategies for the accurate and efficient simulation of fluid flows in engineering and industrial applications. Numerical modeling has become a cornerstone of fluids engineering, providing predictive insight into complex flow phenomena across diverse regimes—from laminar and transitional flows to fully turbulent, multiphase, and reactive systems.

This session aims to highlight methodological developments, algorithmic innovations, and practical implementations that enhance the fidelity and performance of computational fluid dynamics (CFD) simulations. Also, low-order models, finite differences resolution methods and numerical solution of governing equations are welcome. Topics of interest include spatial and temporal discretization techniques for the Navier–Stokes equations, advances in high-order finite volume, turbulence modeling simulation and recent CFD-based optimization techniques. The session also encourages contributions addressing computational performance and emerging methodologies that integrate reduced-order modeling, physics-informed machine learning, AI-driven CFD simulations and digital twin concepts to enable predictive, real-time, and multi-fidelity simulation frameworks.

Specific topics and areas to contribute should include, but not limited to, multiphase and reacting flows, fluid–structure interaction, assessment of fluid phenomena, adaptive mesh refinement, uncertainty quantification, and error estimation. This session seeks to advance the state of the art in numerical methods for fluids engineering, boosting the connection between theoretical modeling, algorithmic research, and industrial or experimental validation, in order to promote the development of robust and efficient computational tools for complex flow systems.

TS Topics: Computational fluid dynamics, Numerical simulation, Turbulence modeling, Multiphase and reactive flows, Fluid–structure interaction, Fluid phenomena assessment, High-performance computing, Data-driven and reduced-order modeling, Uncertainty quantification.