Title: Boundary Element and Allied Numerical Methods for Fluid Flow Problems: Recent Advances and Applications

Chandra Shekhar Nishad, Dr. SPM IIIT Naya Raipur, Chhattisgarh, India.

Vishal Chhabra, K.R. Mangalam University, Gurugram, Haryana, India.

Abstract

Fluid flow problems arise in a wide range of scientific and engineering applications, including aerodynamics, hydrodynamics, porous-media flow, environmental modelling, microfluidics, and fluid–structure interaction. The mathematical modelling of such problems often involves complex partial differential equations, for which analytical solutions are available only for limited geometries and flow conditions. Efficient and accurate numerical methods are therefore essential for the analysis and simulation of realistic fluid-flow phenomena. The Boundary Element Method (BEM) and Boundary Integral Equation (BIE) approaches provide powerful alternatives to conventional domain-based numerical techniques. By transforming governing differential equations into integral equations over the boundary, these methods can reduce the dimensionality of the computational problem and are particularly attractive for external flow, infinite and semi-infinite domain problems. Recent developments in fast algorithms, higher-order approximations, singular integral treatment, and coupled formulations have further expanded the applicability of BEM. The proposed minisymposium aims to bring together researchers, academicians, and practitioners working on Boundary Element Methods and allied numerical techniques for fluid flow problems**.** Particular emphasis will be placed on recent theoretical developments, numerical algorithms, computational efficiency, and challenging applications. Contributions involving Finite Element Methods (FEM), Finite Difference Methods (FDM), Finite Volume Methods (FVM), meshless methods, spectral methods, lattice Boltzmann methods, particle-based methods, and hybrid BEM-based approaches are also encouraged.

Scope and Topics

The minisymposium will cover, but is not limited to:

- Boundary Element and Boundary Integral Equation Methods
- Potential, Stokes, and Navier–Stokes flows
- Free-surface and wave problems
- Porous-media and groundwater flow
- Microfluidics and Low-Reynolds-number flows
- Fluid–structure and multiphysics interactions
- Finite Element, Finite Difference, and Finite Volume Methods
- Meshless, particle-based, and spectral methods
- Hybrid and coupled numerical formulations
- Fast multipole and accelerated BEM
- High-performance and parallel computing
- Data-driven and machine-learning-based numerical methods for fluid flow

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