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IMPLICIT LARGE EDDY SIMULATION ON UNSTRUCTURED MESHES

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The paper describes a general unstructured/hybrid mesh framework suitable for the development of all-scale flow models. The numerical developments use the finite volume discretisation in space with a flexible edge-based data structure. The key elements of the proposed framework include: non-oscillatory advection schemes MPDATA [1], non-symmetric Krylov-subspace elliptic solvers and a class of non-oscillatory forward-in-time (NFT) algorithms for integrating governing PDEs. The NFT algorithms are developed for unstructured meshes, and for compressible and incompressible fluid equations with further extension to rotating stratified flows [2,3,4]. The framework exploits MPDATA properties for Implicit Large Eddy Simulation. Aspects of optimal point-mesh distribution and effects of irregular meshing will be discussed. The advocated algorithms are fully multidimensional, rigorously sign preserving and nonlinearly stable.

Theoretical considerations will be supported with numerical examples for environmental and engineering applications, with simulations of problems involving highly turbulent flows with breaking waves modelled by implicit large eddy simulation, and examples of shallow water flows with drying areas.

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