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RECENT DEVELOPMENTS IN HIGH-ORDER MESH GENERATION

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ABSTRACT

High-order methods are now increasingly being used within computational fluid dynamics as well as in the wider area of computational engineering. They have attractive numerical properties and greater resolution power than more traditionally-used lower order methods, making them ideally suited for high-fidelity simulations, and their compact form versus low-order methods means that they align well with modern computing hardware to maximise performance. However, despite recent advances in solver technology in the last few years, there is a still significant hurdle that stands in the way of more widespread adoption of these methods: the robust generation of high-order curved meshes which conform to and accurately represent complex three-dimensional geometries, which form the backbone of many academic and industrial applications.

Generating a curvilinear mesh typically involves two stages: first, a coarse linear mesh is generated, and then the high-order curvature is projected onto the surface mesh. Invariably however, this combination results in the generation of elements that self-intersect and are therefore unsuitable for simulations. The solution therefore lies in developing an untangling or correction strategy, where the curvature at the boundary is propagated into the interior of the mesh so as to correct invalid elements. This has been the at the forefront of high-order mesh generation, with recent approaches including linear [1] and nonlinear [2] elastic analogies, optimisation through distortion metrics [3] and logarithmic barriers [4], and a variational framework that encompasses a number of these approaches [5].

The purpose of this minisymposium is to provide a platform for researchers in the field of high-order mesh generation to present their latest research. It will offer the opportunity discuss the latest methods related to the generation of curvilinear meshes, techniques assessing the quality and validity of generated grids, assess the application of these mesh generation techniques to real-world problems in computational engineering and fluid dynamics, and provide a means through which researchers can collaborate on new developments in the field.

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