Worskshop

Polygonal methods for PDEs: theory and applications

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The development and analysis of numerical methods for the approximation of the solution to Partial Differential Equations (PDEs) on polygonal and polyhedral meshes have undergone an explosive interest in recent years among the scientific community. Indeed, polygonal and polyhedral meshes offer a very flexible framework to handle, for instance, hanging nodes, different cell shapes within the same mesh and non-matching interfaces, resulting thus in an improved geometric flexibility to correctly represent complicated geometries, interfaces and heterogeneous media. Examples of polygonal and polyhedral methods developed so far include Mimetic Finite Differences, Polygonal Finite Elements, Polytopal Discontinuous Galerkin methods, Hybridizable Galerkin FEMs, Gradient schemes, Virtual Element Methods, Hybrid High Order FEMs.

Such an improved flexibility represents a powerful tool towards the efficient solution of problems featuring complex inclusions (as in geophysical applications) or posed on very complicated or possibly deformable geometries (as encountered in basin and reservoir simulations, in fluid/soil-structure interaction, crack propagation or contact problems). Indeed, in recent years, several discretization methods on polygonal and polyhedral meshes have been developed, analyzed and successfully applied to a wide range of problems arising from Computational Geosciences, Life Sciences, and Computational mechanics, for example. The aim of this Workshop is to bring together experts in the field of polygonal and polyhedral discretization methods for the approximate solution of PDEs in order to discuss the most recent developments in the field and current open challenges. The invited speakers and audience will be leading researchers in the filed of numerical analysis of polygonal and polyhedral methods, and the workshop will include also a discussion of perspectives and advances on the development of polygonal and polyhedral methods for real-life applications in various fields. To this aim, a number of leading experts in the filed of topology optimization, contact mechanics and mesh generation software will be invited. The workshop will cover a broad range of polygonal and polyhedral discretization methods, with a particular focus on the Virtual Element Method.

The topics that will be addressed within the workshop include (but are not limited to) recent advances on:

- a better bridging between the theoretical developments and the applications,
- the enhancement of efficiency (e.g., through fast solution techniques and implementation on modern computer architectures),
- polytopal meshing and related advantages,
- relations and potential mutual benefits between the different methods.

Within the workshop a wide range of areas of applications will also be covered, as for example

- porous media, sub-surface flow, fluid flows,
- structural mechanics problems (contact, cracking, complex materials),
- electromagnetism, multiscale problems, waves and acoustics, coupled and multi-physics problems.