14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19- 24, 2020, Paris, France

BENCHMARKING ADVANCED DISCRETISATION TECHNIQUES: PART I. MESH BURDEN ALLEVIATION WITH APPLICATIONS TO CAD-ANALYSIS TRANSITION, FRACTURE MECHANICS AND HIGHER-ORDER PDES

TRACK NUMBER 20

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Key words: verification and validation, benchmarking, mesh-burden, IGA, XFEM, embedded discontinuities,

ABSTRACT

The last 50 years have seen the birth of a large number of "special" approximation methods aiming at complementing finite difference and finite element methods and alleviating their intrinsic difficulties. Major advances have been made, and yet, it is not always obvious to identify the most relevant advantages and drawbacks of a given approach.

This is the first of a series of symposia organised under the egis of ECCOMAS, IUTAM and EUROMECH. This series is organised by various groups involved in advanced discretisation techniques and aims at:

i) providing a set of benchmark problems and associated protocols for computational mechanics problems;
ii) providing a forum for long-term discussions around the theme of advanced discretisation methods; and
iii) unifying different groups of thought in the field of advanced discretisation methods.

In this first symposium, focus will be given to fracture approximation and mesh burden alleviation, including specifically:

- fracture mechanics problems (enriched approximations versus embedded discontinuities);
- locking and mesh distortion alleviation (smoothed finite element methods versus hybrid methods);
- CAD analysis transition
  - isogeometric, geometry-independent field approximations;
  - implicit boundary approaches and CutFEM;
- high-order PDEs (meshfree approximations, isogeometric analyses).

The participants will have the chance to test their methods on a set of specially designed benchmark problems. In view of the Open Science, Open Data, Open Source, Open Protocol initiative of the European Union, those problems will be published as part of a figshare (or equivalent) repository and published online. Solution files will be made public and participate to streamlining computational mechanics research. Finally, results will also be published in a special volume of Advances in Applied Mechanics (Elsevier).