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RECENT ADVANCES IN ENRICHED FINITE AND BOUNDARY ELEMENT METHODS

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ABSTRACT

The mini-symposium intends to give an overview of finite and boundary elements with non-polynomial ansatz and test functions, both foundational mathematical aspects, algorithmic challenges and applications in engineering.

Originally introduced by Babuška and Melenk in 1995, generalized or enriched finite element methods incorporate a priori knowledge on the problem field and hence resolve oscillatory or singular behaviour on coarse mesh grids, using appropriate enrichments of the ansatz and test spaces. They thereby lead to a significant reduction in the computational effort, e.g. for wave problems at high frequency, stationary and time dependent boundary layers in heat transfer or fluid mechanics, or for the singular stresses in crack propagation. An emergent area concerns transient problems, for which both space and space-time enrichments prove promising.

The approach is of interest both for finite and boundary elements, with a close interaction between the two approaches.

In this mini-symposium we aim to give a broad overview of the field, with presentations by leading senior academics supplemented by talks of younger researchers, also from industry. A recent mini-symposium at the conference “MAFELAP – The Mathematics of Finite Elements and Applications 2016” proved the particular value of bringing together computational engineers and mathematicians with specialists from different application areas, such as computational and fluid mechanics, wave and scattering problems or geosciences.

In particular, we expect to have talks on extended finite element methods (XFEM), where singular functions are added near a corner or crack tip, and talks about plane wave "Trefftz" / partition of unity / meshless methods for wave and Helmholtz equations at high frequency.