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THE RELEVANCE OF AN ACCURATE GEOMETRIC REPRESENTATION ON HDG DEGREE ADAPTIVE COMPUTATIONS

Ruben Sevilla[1] **and Antonio Huerta**[2]

[1]Zienkiewicz Centre for Computational Engineering, College of Engineering, Swansea University, Swansea, SA1 8EN, Wales, UK.

[2]Laboratori de Càlcul Numèric (LaCàN), ETS de Ingenieros de Caminos, Canales y Puertos, Universitat Politècnica de Catalunya·BarcelonaTech, Spain

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One aspect usually ignored when devising degree adaptive schemes is the geometric representation of domains with curved boundaries. Despite it is now well known that a poor representation of the geometry can have an important effect on the results of a simulation, the most extended practice consists on maintaining the shape of the elements during the degree adaptive process.

Three approaches to perform a degree adaptive process in domains with curved boundaries will be discussed. The first one consists of fixing the shape of the curved elements and changing the degree of the functional approximation. The second approach, proposed here, is to employ the so-called NURBS-enhanced finite element method (NEFEM, [1]) that enables to exactly represent the geometry of the computational domain irrespective of the degree of the polynomials used to approximate the solution. The third approach, not attractive in real adaptive processes, consists of changing the geometry representation of the computational domain at each iteration of the degree adaptive process to represent with the same degree of polynomials both the geometry and the solution.

The second approach proposed here considers, for the first time, the combination of the so-called NURBS-enhanced finite element method (NEFEM) and the HDG rationale [2].

A number of numerical examples will be considered to compare the different degree adaptivity approaches. Furthermore, this work presents a simple idea to verify solvers that are capable to use different degrees of approximation for the solution in different elements.

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