Construction of Hdiv finite element spaces for three-dimensional geometries

Douglas A. Castro[†], Philippe R. B. Devloo*, Agnaldo M. Farias*, Sônia M. Gomes*, Omar D. Triana*

[*] Universidade Estadual de Campinas
Av. Albert Einstein, 951, 13083-852, Campinas, SP, Brasil
phil@fec.unicamp.br, agnaldofarias.mg@gmail.com , songiag@ime.unicamp.br , omaryesiduran@gmail.com

[†] Universidade Federal de Tocantins – Campus Gurupi
R. Badejós, chácara 69 e 72, Lt. 07, Zona Rural, Gurupi, TO.
dacastro@mail.uft.edu.br

ABSTRACT

Having in mind applications to the simulation of porous media flows, a classical approach is the use of mixed formulations [1], which are characterized by simultaneous calculations of pressure and velocity fields. Approximation spaces suitable for the velocity variable are of *Hdiv* type, which are formed by vectorial functions not necessarily continuous, but having continuous normal components at the interfaces between elements of the domain partition. This property is crucial for mass conservation, a fundamental property for this kind of application.

This work focuses on the construction of new *Hdiv* finite element spaces for three-dimensional curved meshes formed by tetrahedral, hexahedral or prismatic elements. The adopted methodology for the construction of *Hdiv* bases consists in using hierarchical scalar H^1 bases multiplied by vectors that are properly chosen over the geometrical elements. This methodology has already been successfully applied to bi-dimensional triangular and quadrilateral partitions composed by elements whose boundaries are rectilinear by parts [2].

The implementation and verification of the proposed *Hdiv* spaces are performed in the scientific computation environment named NeoPZ (http://code.google.com/p/neopz). This is a finite element computing library based on object-oriented programming. The required H^1 bases, for a variety of three-dimensional geometries, and bi-dimensional *Hdiv* bases are already implemented in NeoPZ. Verification results are shown for curved triangular, quadrilateral, and hexahedral meshes.

REFERENCES

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