hp MORTAR FINITE ELEMENT METHODS FOR NON-MATCHING GRIDS TUNED TO PARALLEL IMPLEMENTATION

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In the last decade, non-conforming domain decomposition methods such as *hp* mortar finite element methods have been shown to be reliable techniques for several engineering applications that often employ complex finite element design [1, 2, 3, 4]. With this technique, one can conveniently assemble local subcomponents into a global domain without matching the finite element nodes of each subcomponent at the common interface. We employ the mortar finite element formulation in conjunction with *higher-order* elements, where both mesh refinement (h-version) and degree enhancement (p-version) are combined to increase accuracy. An added advantage of this approach is that mesh refinement can be imposed selectively on those components where it is required. Moreover, different variational problems in different subdomains can be combined.

The mortar finite element method has proven to be a good candidate for *hp* implementation in two dimensions. In this talk, we will present both theoretical and computational results for the stability and convergence of hp mortar finite element techniques in three dimensions, both in the presence of non-quasiuniform meshes and varying polynomial degree. Our numerical results show optimality for the resulting non-conforming method for various h, p and hp discretizations.

References

[1] Ben Belgacem F, Seshaiyer P, "Optimal convergence rates of hp mortar finite element methods for second-order elliptic problems," *RAIRO Mathematical Modelling and Numerical Analysis*, v. 34, p. 591-608, 2000.
[2] Chilton L K, Seshaiyer P, "The *hp* mortar domain decomposition method for problems in fluid mechanics," *International Journal for Numerical Methods in Fluids*, v. 40, p. 1561-1570, 2002.
[3] Seshaiyer P, Suri M, "Uniform hp convergence results for the mortar finite element method," *Mathematics of Computation*, v. 69, p. 521-546, 2000.
[4] Seshaiyer P, Suri M, "hp submeshing via non-conforming finite element methods," *Computer Methods in Applied Mechanics and Engineering*, v. 189, p. 1011-1030, 2000.