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SUPERCONVERGENCE IN GENERALIZED FINITE ELEMENT METHOD

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ABSTRACT

Superconvergence is an important and well known feature of the classical Finite Element Method (FEM). It allows accurate approximation of the derivatives of the solution of the underlying boundary value problem, which could be used to estimate the error in various ways. It was recently shown that a class of Generalized finite Element Methods (GFEM) also has the superconvergence property. This class of GFEM uses special partition of unity (PU) functions with "flat-tops", i.e., the value of each PU function is unity in a proper subset of its support. However, the superconvergence in GFEM has been studied only in the interior of the domain essentially by showing that the dominant part of the GFEM error in the interior of the domain is periodic.

In this talk, we discuss the superconvergence in GFEM near the boundary of the domain. In particular, we show that the dominant part of the GFEM error near the boundary can be written as a sum of two functions. One of these functions is globally periodic and is the dominant part of the error in the interior of the domain, where as, the second function is a "boundary layer", which is negligible outside a small neighborhood of the boundary. Using this expression of the dominant part of the GFEM-error and an averaging technique, we will obtain a "superconvergent recovery" of derivative of the exact solution.