

ACCURATE UPPER BOUNDS OF THE ERROR IN THE FINITE ELEMENT METHOD USING AN EQUILIBRATED MOVING LEAST SQUARES RECOVERY TECHNIQUE.

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ABSTRACT

Reference [1] shows that the evaluation of upper bounds of the error in energy norm based on recovery techniques requires the recovered solution to be both continuous and statically equilibrated. In [1] the equilibrium is obtained locally (patch-by-patch) using a modification [2] of the Superconvergent Patch Recovery technique (SPR), whereas the continuity is enforced by a postprocessing based on the partition of the unity concept which introduces small lacks of equilibrium. Thus, the evaluation of the upper bound requires the use of an additional postprocess (which involves the evaluation of the error in the displacement field) to account for the equilibrium defects.

In this paper we present preliminary results of a novel technique developed to obtain upper bounds of the error in energy norm through a recovery technique based on a Moving Least Squares (MLS) approach. The continuity requirement is easily satisfied because of the MLS approximation properties. On the other hand static admissibility has been obtained using the Lagrange multipliers technique to impose the satisfaction of the equilibrium equations (both, in the interior of the domain and along the Newman boundaries) to the local polynomial approximation of the stresses, following a procedure similar to that described in [2].

The numerical analyses have shown that the proposed technique provides very accurate upper bounds of the error in energy norm. The accuracy of the results is similar to that provided by an enhanced version [3] of the technique described in [1], although the proposed technique does not require to account for any lack of equilibrium.

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- [2] Ródenas JJ, Tur M, Fuenmayor FJ, Vercher A. Improvement of the superconvergent patch recovery technique by the use of constraint equations: The SPR-C technique. *International Journal for Numerical Methods in Engineering* 2007; 70:705–727
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