VI International Conference on Adaptive Modeling and Simulation ADMOS 2013
J. P. Moitinho de Almeida, P. Díez, C. Tiago and N. Parés (Eds)

EXPLICIT EXPRESSIONS OF DUAL LOADS FOR ACCURATE ERROR ESTIMATION AND BOUNDING IN GOAL ORIENTED ADAPTIVITY

J.J. Ródenas^{*}, E. Nadal^{*}, O.A. González-Estrada[†], F.J. Fuenmayor^{*}, S.P.A. Bordas[†], and P. Kerfriden[†]

*Centro de Investigación en Tecnología de Vehículos (CITV) Universitat Politècnica de València ,C/ Vera, S/n, E-46022-Valencia, Spain e-mail: {jjrodena, ffuenmay}@mcm.upv.es ennaso@upvnet.upv.es

[†]Institute of Mechanics & Advanced Materials, Cardiff University, School of Engineering, Queen's Building, The Parade, Cardiff CF24 3AA Wales, UK. e-mail: {bordass, estradaoag}@cardiff.ac.uk, pierre.kerfriden@gmail.com

Key words: Quantities of Interest, Error estimator, Goal oriented adaptivity

Abstract. Recently, Goal Oriented Adaptivity (GOA) has been an active research area because of its advantages in terms of computational cost and accuracy. A widely used technique to perform a Goal Oriented (GO) analysis consists in solving two Finite Element (FE) problems: the primal one, which is the actual problem and the dual or adjoint one, which is an auxiliary problem depending on the Quantity of Interest (QoI) whose loads are used to extract the QoI.

Traditionally, under the FE framework, the force vector for the dual problem has been numerically evaluated using the FE discretization without knowing the explicit expressions of the loads for the dual problem. Our objective in this paper is to obtain the explicit expression for the extraction loads used in the dual problem for linear QoI in the context of linear elasticity, that is boundary forces, body loads and initial stresses and strains. In particular, we will evaluate the explicit loads for the dual problem when the QoI is the Generalized Stress Intensity Factor (GSIF) that characterizes the singularity in singular problems. In this case the extraction loads can be represented by a distribution of body forces and initial strains over a domain around the singularity.

A recovery procedure, which makes use of the explicit expressions of the applied loads to enforce the local satisfaction of the equilibrium equation for an accurate stress representation [2], has been used to obtain accurate estimations and bounds of the error in the QoI using a ZZ-type error estimator [1] as shown by the numerical tests.

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