COUPLING OF MFS AND ANM FOR SOLVING NONLINEAR ELASTICITY PROBLEMS

O. ASKOUR\textsuperscript{a}, A. TRI\textsuperscript{b}, B. BRAIKAT\textsuperscript{a}, H. ZAHROUNI\textsuperscript{c,d}, M. POTIER-FERRY\textsuperscript{c}

\textsuperscript{a} Laboratoire d’Ingénierie et Matériaux (LIMAT), Faculté des Sciences Ben M’Sik, Université Hassan II de Casablanca, BP 7955, Sidi Othman, Casablanca, Maroc.
\textsuperscript{b} Laboratoire de Mécanique /FSAC, Institut Supérieur des Etudes Maritimes, Route El Jadida Km7 Casablanca, Maroc
\textsuperscript{c} Laboratoire d’Etude des Microstructures et de Mécanique des Matériaux, LEM3, CNRS, UMR 7239, Université de Lorraine Metz, Ile du Saulcy, 57045 Metz, France
\textsuperscript{d} Laboratory of Excellence on Design of Alloy Metals for low-mAss Structures (DAMAS), Université de Lorraine, France

Abstract :

In this work, we propose an algorithm that combines the Method of Fundamental Solutions (MFS) with the Asymptotic Numerical Method (ANM) for solving nonlinear elasticity problems. The ANM allows one to transform the nonlinear differential equations into a sequence of linear differential equations having the same tangent operator. Each linear resulting problem is then solved by using MFS. This last technique belongs to meshless collocation methods which has attracted considerable attention in recent years. It consists in constructing the solution by considering a linear combination of fundamental solutions of the differential operator. Regularization methods such as Truncated Singular Value Decomposition (TSVD) associated with the Generalized Cross Validation (GCV) criterion have been used to solve the ill-conditioned resultant linear systems. Two examples of nonlinear elasticity problems have been studied and have shown the robustness of the proposed algorithm.

Keywords: Method of Fundamental Solutions, Asymptotic Numerical Method, nonlinear elasticity, regularization methods.