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Rapport

de Prof. Alberto Corigliano, Dipartimento di Ingegneria Strutturale, Politecnico di Milano, Italy nommé par le directeur de l'E.N.S. de Cachan pour examiner la thèse de M. Hong-Minh NGUYEN ayant pour sujet:

Une stratégie d'identification robuste pour la localisation et la rupture

The Thesis concerns the problem of parameter identification for linear and non linear constitutive behaviours with the final purpose to formulate a procedure for parameter identification in the presence of localization and rupture.

The subject is of great importance and has gained much attention in the recent scientific literature. The Author develops his research starting from previous work of the group at LMT-Cachan and introducing original contributions with particular reference to the numerical techniques involved in the proposed approach.

The work is organised in an introduction, five chapters and a conclusion in addition to a technical annexe; the total amount of pages is 195, included references.

The first two chapters are dedicated to a state of the art review on identification techniques and to a deep discussion of previous works from which the Thesis was developed. In the first Chapter various identification methodologies are discussed and their advantages and disadvantages are clearly explained. Among the existing approaches, three different regularization techniques and the "Error in Constitutive Law" methods (ECLm) are described with some details. The Chapter gives a clear and comprehensive review of the most meaningful results in the literature, thus showing a good knowledge of the problem acquired by Mr Nguyen. The second Chapter is focussed on the discussion of the identification method based on the notion of the ECLm, proposed in the late seventies by Pierre Ladevèze. The purpose of the Chapter is to show how the ECLm can be applied to an elasto-dynamic problem with wave propagation and redundant boundary conditions such that found in the Hopkinson bar. The major critical points of the procedure and the results obtained in the previous work by the LMT group are clearly explained; the discussion of the second Chapter set up the stage for subsequent contributions discussed in Chapters 3-5.

The third, fourth and fifth Chapters can be considered as the core of the Thesis, in which the new procedures proposed are described and tested on a series of examples.

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In the third chapter the focus is on the technique adopted for the solution of the so called "Probleme de base". It is shown that the solution can be made equivalent to a matrix Riccati equation; a comprehensive discussion on methods for the analytical and/or numerical solution of this equation is therefore presented. The chosen method is then applied to the solution of the reference problem of a 1D bar subject to dynamic loading. The results obtained with the new methodology are then compared to previous ones, showing that the new method is able to give a substantial improvement in the solution. An application to an elastic 2D case is also proposed.

The fourth Chapter is dedicated to the extension of the methodology formulated for linear elastic behaviour to the case of a visco-plastic constitutive law. In order to overcome the additional difficulties related to non-linearities of the direct problem, a solution strategy based on a particular de-coupling of the governing relations is proposed. This de-coupling is suggested by the so-called Large Time Increment Method proposed by Pierre Ladevèze in the eighties. The chosen method proves to be effective and it is proved that the convergence is guaranteed provided that the "descent" predictor operator coincides with the tangent one. The method is applied to a 1D visco-plastic bar subject to dynamic loading and redundant boundary conditions.

The final fifth Chapter concerns the application of the identification techniques developed in the previous chapters to the problem of parameter identification of damage models. This application is entirely new and can be considered as a first step toward the main goal of the whole Thesis of being able to identify material parameters in the presence of rupture and localisation. The examples shown appear to be encouraging with this respect.

Original contributions can be found in the whole Thesis; in particular they emerge in Chapters three four and five. In these Chapters the Candidate first shows how the challenging task of solving the ECL based procedure in the context of wave propagation and redundant boundary conditions can be tackled through the solution of a Riccati equation and then applies the approach to highly non-linear problems.

Unfortunately, the work has only marginally explored the real effectiveness of the new methodology proposed and the examples discussed are almost exclusively uni-dimensional ones.

Nevertheless, it appears from the whole Thesis that a great amount of work has been done and that the quality and the novelty of the results presented are really significant.

Taking into account the above considerations, I declare that the Thesis of Mr. Hong-Minh Nguyen is of very good quality and has the merit for the participation to the final discussion.

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