DESIGN OPTIMIZATION OF A NEW HETEROGENEOUS MECHANICAL TEST - NUMERICAL APPROACH AND EXPERIMENTAL VALIDATION

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ABSTRACT

The aim of this work is to present the numerical methodology used for specimen design and experimentally validate the heterogeneous butterfly mechanical test in the parameter identification framework. For this aim, DIC technique and a Finite Element Model Up-date inverse strategy are used together for the parameter identification of a DC04 steel, as well as the calculation of the indicator.

Keywords: Mechanical test, specimen design, plasticity, constitutive model, parameter identification, full-field measurements.

INTRODUCTION

Standard material parameters identification strategies generally use an extensive number of classical tests for collecting the required experimental data. However, a great effort has been made recently by the scientific and industrial communities to support this experimental database on heterogeneous tests [1]. These tests can provide richer information on the material behavior allowing the identification of a more complete set of material parameters. This is a result of the recent development of full-field measurements techniques, like digital image correlation (DIC) that can capture the heterogeneous deformation fields on the specimen surface during the test [2].

More recently, new specimen geometries were designed to enhance the richness of the strain field and capture supplementary strain states. The butterfly specimen is an example of these new geometries, designed through a numerical optimization procedure where an indicator capable of evaluating the heterogeneity and the richness of strain information [4-7]. However, no experimental validation was yet performed.

RESULTS AND CONCLUSION

A DIC technique and a Finite Element Model Up-date inverse strategy are used together for the parameter identification of a DC04 steel, as well as the calculation of the indicator. The experimental tests are carried out in a universal testing machine with the ARAMIS measuring system to provide the strain states on the specimen surface. The identification strategy is accomplished with the data obtained from the experimental tests and the results are compared to a reference numerical solution.
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