On the inverse identification of DP600-steel constitutive parameters by a synthetic image approach based on digital image correlation

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Abstract

To describe the material behaviour, computer-aided engineering systems rely on constitutive models and their parameters. Recent advances in digital cameras and image processing have revealed novel approaches for experimental solid mechanics. The development of full-field measurements techniques has been combined with improved inverse identification methods in a photomechanical approach. This approach can reduce the number of experimental tests required to accurately identify the material constitutive parameters, given that the experimental test configuration is rich enough. In this work, a numerical simulation of the Arcan test using a DP600-steel specimen was used to feed the inverse parameter identification approach. The numerical results are used to generate synthetic images of the specimen with a speckled pattern, which were then processed by digital image correlation (DIC) and used as a reference in the identification procedure. The finite element model updating technique is used to identify the constitutive parameters by iteratively updating the parameters set by means of an optimization algorithm. The results from the iterative numerical simulations will also be used to iteratively generate synthetic images and processed by DIC with the same DIC setting parameters used on the reference. This approach addresses numerous inconsistencies that exist in the direct comparison approach.