MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialized Technologies, including Nanotechnology (8)

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APPLICATION OF A TWO STEP DIGITAL IMAGE CORRELATION ALGORITHM IN DETERMINING POISSON'S RATIO OF METALS AND COMPOSITES

Abstract

Accurate determination of Poisson's ratio is a demanding yet essential part of any material characterization program that aims to facilitate structural analysis. This involves measuring longitudinal as well as very small lateral strains during uniaxial testing. For such applications, usually biaxial extensometers or strain gauges are employed. However, use of strain gauges is often restricted by incompatible material surface or miniature size samples where strain gauge mounting is not possible or simply by the costs involved in using expensive gauges. In this work, a noncontact, robust and easy to use Digital Image Correlation technique has been proposed to calculate the strains and finally Poisson's ratio in a wide range of metal and composite samples where conventional measurement techniques are not feasible. The strain calculated using DIC method was compared from those measured using strain gauges and extensometer to validate the technique. The technique works on a two step correlation based search algorithm that is able to achieve sub-pixel accuracy with minimal input from the user. The use of such an algorithm for strain and displacement measurements not only reduces the costs involved in testing but also permits multiple measurements of strain to be made from a single test with high accuracy. The multi step search algorithm makes the technique very robust as correlation matches are seldom lost even for moderate to high strain levels. The technique proved to be an accurate, efficient and economical way for determining Poisson's ratio of metals and composites.

Keywords: Digital Image Correlation, Poisson's ratio, Deformation measurement, Composites, Micro strain measurement, Non contact strain measurement