THE APPLICATION OF DIGITAL IMAGE CORRELATION TECHNIQUES FOR MEASURING RESIDUAL STRESS BY INCREMENTAL HOLE DRILLING

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Abstract

The measurement of residual stress using the incremental hole drilling is well established, but the main limitations with the conventional strain gauge approach are the requirements for surface preparation and the need for accurate alignment and drilling, together with the restricted range of hole geometries commensurate with the specific gauge designs, and the limited range of strain data averaged over the footprint of the strain gauge grid. Recent developments to extend the method have seen the application of full field optical techniques such as ESPI and holographic interferometry for measuring the strain fields around the hole, but these methods are sensitive to vibration and this limits their practical use to controlled laboratory environments.

There are significant potential benefits therefore of using a more robust technique based on digital image correlation (DIC), and work is presented in this study on the development of the method for measuring surface displacements and strain fields during hole drilling. Some of the practical issues associated with the technique development, including the optimization of applied patterns, the development of the optical system and integration with current hole drilling equipment are discussed, together with results on a range of materials and components with different stress profiles. Validation data comparing results from conventional strain gauge data and FE models is also presented.

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Permission is granted to post the abstract on the DXC and affiliated web sites.

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