Challenges of Robust Statistical Characterization Using Digital Image Correlation Technique for Structural Applications

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Digital Image Correlation (DIC) technique is a relatively new experimental optical method to measure the entire deformation field at structural surfaces as a function of applied load. Generated distributions are based on individual measurements for a significant population of randomly distributed speckles and corresponding statistical approximations. Practical engineering interest, however, is rather focused on strains defined as derivatives of displacements. Considering inevitable scatter of individual measurements, the statistical part of this problem is reduced, therefore, into characterization of quasi-random derivatives (strains) for measured quasi-random functions (displacements). The work lists major challenges associated with robust implementation of this statistical problem. A set of simple benchmarking statements is proposed for evaluation of computational efficiency for corresponding statistical analysis. Since exact solutions for these statements are already known, they can be used for accuracy assessment of current and new DIC-related statistical implementations.