

A Method for Measuring Displacement and Strain of Rubber Sheets with Large Deformation Using Digital Image Correlation

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Abstract: This study establishes a method to measure the displacement and strain of rubber with large and fast deformations using digital image correlation. In order to elucidate the mechanism of growth of a crack and to investigate the complex behavior of a crack tip, which is important for that purpose, displacement and strain near the crack where large strains are locally generated by stress concentration are measured. A displacement restraint rubber sheet of a strip fixed at upper and lower ends with an initial crack is used as a test piece. A constant rate displacement load is applied to it, its state is photographed using a digital camera. Displacement is obtained using the digital image correlation from the images obtained from a series of tests. By processing multiple images in succession, the displacement corresponding to large and high-speed deformation are acquired. Furthermore, the measurement range of the image is divided into upper and lower parts at the cracks, and the measurement can be performed separately, making it possible to handle errors caused by crack discontinuities. The logarithmic strain is obtained from the obtained displacement results. By applying the proposed method, it is possible to measure displacement and strain even for rubber test pieces with large deformation.

Keywords: Rubber Materials; Crack; Tensile Test; DIC

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