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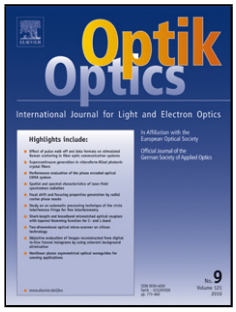

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Study of the quality of wood texture patterns in digital image correlation

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Abstract. Wood texture (WT) is sometimes used as speckle patterns in digital image correlation (DIC) method. However, the various WT due to orthotropic behavior of wood cause it vary difficult to assess the quality of WT and the accuracy of DIC analysis. In this paper, the mean directional intensity derivative (MID) was used to qualify the quality of the WT patterns for digital image correlation. To verify the effectiveness and correctness of this parameter, numerical displacement experiments in *x* and *y* directions were performed. The results show that the measurement errors of WT patterns in *x* and *y* directions are related to the mean directional intensity derivatives. The WT pattern with a lower MID in *x* or *y* direction has a smaller measurement error when the mean intensity gradient are nearly equal to each other, and a higher values of the mean directional intensity derivative in one direction leads to the standard deviation error decrease. Furthermore, to produce equivalent measurement errors in the two directions, an elliptic (or rectangular) subset whose ratio of the radius between *x* and *y* directions should be approximately equal to the inverse ratio between MID_x and MID_y may be more appropriate for WT patterns.

Keywords: artificial speckle pattern; digital image correlation (DIC); mean directional intensity derivative (MID); subset size; wood texture.

1. Introduction

As an effective optical test technique for full-field deformation measurement, digital image correlation (DIC) has been extensively applied in experimental mechanics [1-3]. This method is conducted by comparing pictures photographed from the surface of samples before and after deforming. It has been recognized that the measurement errors in testing displacements by DIC are closely related to the quality of various speckle patterns [4-6]. The different quality of speckle patterns may lead to different measured displacements even with the same calculation parameters such as correlation criteria [7], sub-pixel registration algorithm [8] and subset size [9-10]. Usually, artificial

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