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Checkup for aging artwork—Optical tools to monitor mechanical behaviour

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Abstract

Deterioration of artwork is often connected to mechanical material degradation that starts on microscopic scales. Insight into decay mechanisms can therefore be obtained by monitoring microscopic deformation and displacement fields. Thus, the proper optical methods become an ideal tool for restorers and conservators, the more as they are non-intrusive and remotely applicable. We show how the scope of modern coherent metrology can be adapted to this aim. Refinements of correlation imaging, speckle interferometry and low-coherence detection provide a wealth of methods that have been applied successfully in historical objects.

Keywords: Inspection of art work; Electronic speckle pattern interferometry; Low-coherence ESPI; Phase shifting interferometry; Vibration monitoring; Time-average ESPI

1. Introduction

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Often decay starts at the microscopic level initially producing weakening of the mechanical cohesion in the sample. This shows up in irregular minute displacements or changes in the microtopography of the object's surface. Thus, optical deformation mapping methods can provide essential data on the distribution of mechanical loads in the

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a computer. Subtraction of successive images, e.g., yields so-called correlation fringes that represent lines of constant displacement in the direction of the sensitivity vector determined by illumination and observation geometry. Since the interpretation of fringe systems is difficult and even ambiguous, phase shifting strategies from ordinary interferometry were adapted. The recording of several images with well-defined phase shifts in the reference wave allows automated evaluation by spatial phase unwrapping and provides unambiguous deformation data [4].

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