Axial loading verification method for small bones using carrier fringes in speckle pattern interferometry

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Abstract

A computerized system for real-time displacement visualization using carrier fringes in an electronic speckle in-plane sensitive interferometer allows force calibration for micro-displacement analysis of rat bones and verification of axial loading conditions. Once the force has been calibrated and the load is applied along the bone axis, the difference-of-phase method is used to obtain the phase map, which after phase unwrapping, allows the evaluation of the displacements produced by the bone deformation. The proposed method avoids common loading mistakes using first carrier fringes to assure that the loads are within the measuring capabilities of the in-plane interferometer and the Carré phase-stepping method to compensate for linear phase step miscalibration. The experimental results obtained with the calibration of loading forces and axial loading verification show the advantages of the system proposed here over a system which uses a cantilever configuration to make a similar bone deformation analysis.