A novel method for identifying constitutive parameters based on Moiré interferometry fringe pattern

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Abstract: The moiré interferometry can be used to measure the in-plane deformation of the loaded specimen. In order to obtain the deformation data from the moiré patterns, various techniques for fringe processing have been proposed. As an application, the moiré interferometry can be utilized to identify the constitutive parameters in combination of elasticity theory at a given loading configuration. However, the fringe processing may introduce errors. In order to reduce the mentioned errors and realize automatic identification. There is urgent need to develop new approach to identify the constitutive parameters based on the fringe pattern. In this paper, a novel one-step inversion method based on fringe pattern (IMFP) is proposed, which utilizes the unique relationship between the moiré fringe pattern and the material constitutive model parameters to directly extract the constitutive parameters from the fringe pattern. In calculation of IMFP, by comparing the measured fringe pattern and a series of digital moiré fringe patterns obtained by simulation, the inversion results can be calculated by the multi-objective optimization algorithm. Besides, the adaptability and accuracy of the IMFP are discussed in detail. The successful results verify that the IMFP method has the advantages of automatic process, better robustness, and high reliability.