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Tesis: "INTELLIGENT ALGORITHMS FOR PROCESSING METROLOGICAL IMAGES"

Resumen:

In recent years numerous investigations have focused on the problem of fringe pattern demodulation, which has become one of the main challenges in the areas of optical metrology and computer vision. Currently, there is no known method capable of obtaining accurate measurements, especially in transient events with the presence of noise, under-sampling and closed fringes. There are encouraging results through the use of optimization models, such as genetic algorithms, which have demonstrated their efficiency, and, it is a line of research that has gained some momentum in recent decades due to technological progress.

In this work, an investigation of complex fringe pattern recovery using evolutionary computation techniques, in particular the metaheuristics known as Simulated Annealing and Variable Mesh Based Optimization, is presented. A new system of automatic phase field partitioning of the fringe pattern without overlap, based on the spatial frequency, is introduced, which facilitates the demodulation process, especially in those models that use a polynomial adjustment to approximate the fringe pattern.

Another important aspect presented in this research is the modeling of the objective function using Bézier surfaces as a fitting function, thus generating a novel approach to this type of problems, thanks to the versatility of Bézier surfaces in the area of Computer Vision.

On the other hand, this technique allowed us to characterize and optimize the input parameters of the metaheuristics, as well as to restrict the search space and considerably reduce the demodulation times, which was one of the main challenges of these models using Artificial Intelligence techniques. Finally, the advantage of using Bézier surfaces compared to the use of Zernike polynomials and two-dimensional polynomials reported in the state of the art is highlighted, and some future works are discussed that may contribute to a substantial improvement of the problem presented here.