A high performance approach for parallel computing of fibre Bragg grating strain profiles using graphics processing units

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Abstract: This work proposes an efficient approach to recover the mechanical strain profile applied on fibre Bragg grating sensors. The proposed method is based on differential evolution and uses only the sensor reflectivity, without requiring phase information. The method has been shown to be highly parallelisable, with the fitness evaluation procedure implemented on graphical processing units. Experiments were performed to evaluate the performance of the method on three distinct graphic processing units (GPU), under a series of increasing loads. An enhancement up to three orders of magnitude in performance was obtained in respect to other evolutionary method proposed in the literature for the same purpose. Furthermore, it was observed that, for smaller problem sizes, the GPU clock rate was more significant than the number of cores of the GPU.

Keywords: graphical processing unit; GPU; differential evolution; performance evaluation; sensors; parallel computing; computational intelligence; fibre Bragg grating; FBG; optical fibre; sensoring.

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