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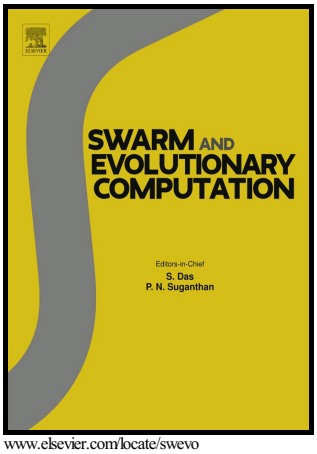

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A novel teaching-learning based optimization approach for design of broad-band anti-reflection coatings

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Abstract

The design of thin-film multilayered anti-reflection (AR) coating is quite an intricate task due to highly nonlinear and complex dimensional search space, which includes many local minima. In this paper, a novel teaching-learning based optimization (TLBO) approach is employed to design ultra-low reflective coating over a broad wavelength-band using multilayer thin-film structures for optoelectronic devices. The algorithm is implemented using LabVIEW as a programming tool. Various design specific input parameters such as scanning range of wavelengths, step-size, angle of incidence, number of layers, the name and sequence of coating materials etc. are required to be fed by the user on the graphical user interface. The algorithm minimizes the average reflectivity computed over given wavelength range by tuning the thickness of layers in the multilayer stack. The reliability and evolution of design solution with iterations have been systematically investigated for different learner-sizes. Finally, using the optimized learner size and desired number of iterations, the optimum AR design is obtained in terms of the thickness of each layer for the multilayer AR coating. The effectiveness of the TLBO approach has been compared with that of an established algorithm, i.e. genetic algorithm (GA), by means of Wilcoxon singed ranked test. It is concluded that the TLBO can be a very efficient, simpler and relatively faster approach to address complex optimization problems such as broad-band AR coating designs.

Keywords: Anti-Reflection Coating, Optimization Algorithms, Teaching-Learning Based Optimization, Thin-Films and LabVIEW.