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"**EVOLUTIONARY OPTIMIZATION FOR AN EFFICIENT AND RELIABLE DESIGN IN ELECTROMAGNETIC ENGINEERING**"

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Abstract

In the last decades, thanks to the growing computational capabilities, optimization techniques based on evolutionary algorithms (EAs) have received great attention and they have been successfully applied to a wide number of problems in engineering and science. As a matter of fact, EAs have shown many attractive features suitable for dealing with large, complex, and nonlinear problems. More specifically, they are *hill-climbing* algorithms which not require the differentiation of the cost function, which is a "must" for gradient-based methods. Moreover, *a-priori* information can be easily introduced, usually in terms of additional constraints on the actual solution, and they can directly deal with real values as well as with a coded representation of the unknowns (e.g., binary coding). As regards to the architecture of their implementation, EAs can be effectively hybridized with deterministic procedures and are suitable for parallel computing.

Despite several positive advantages, many times EAs are used as "black-box" tools without an adequate knowledge of their peculiarities and functionalities. Therefore, sub-optimal solutions can be obtained or the achievement of reliable solutions prevented.

In this talk, a review of EA-based approaches for electromagnetic engineering is presented. Starting from the theoretical framework of EAs and the state-of-the-art, some meaningful examples of EA-based approaches for inverse scattering and antenna design are reported to show the capabilities, but also current limitations, of these techniques. Finally, some indications on future trends of EA-based techniques are envisaged.

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