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Evolution of Distribution Algorithm for Constrained Optimization in Structural Design

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Nowadays, the need to deal with limited resources together with the new discovered awareness of the human over-exploitation of the environment, has made the optimization a cutting edge topic both in scientific research and in the different professional fields [1, 2, 3, 4].
In this paper, a particular evolutionary optimization algorithm is presented: The Evolution of Distribution Algorithm (EDA). This type of algorithm has been developed to be used in search-based constrained optimization problems which are difficult and time-consuming to be solved by other general algorithms. Being an evolutionary algorithm, the main idea is to generate a population of solutions and evaluate the objective function to each one of them. Then, using the information obtained from the previous generations, the algorithm step-by-step will generate new populations that will tend to the best value of the objective function. In EDA, the population of solutions defines a probability density function (PDF) and, by integration, a cumulative density function (CDF), which is used for the generation of the next generation [1, 2, 3, 4].
In structural design optimization problem, it is very common that the best solution is very close to the constraint function. The main advantage of applying the EDA for constrained optimization problem is that each generation of solutions is obtained starting from a PDF that is defined on the whole domain. This means that, for each generation, the solutions have a probability to be on the unfeasible domain space, maintaining the information about the objective function in the evolution process. In the present research, an original EDA and related self-made code are presented together with a specific application to structural optimization problem, in order to show the effectiveness of the obtained results and to make a comparison with other evolutionary optimization algorithms.

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