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MINIMIZING THE CONSTRAINED WEIGHT OF FRAMES WITH NASH GENETIC ALGORITHMS: A MUTATION RATE STUDY

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Among the recent advances in evolutionary algorithms for engineering design and optimization [1], the hybridization of evolutionary algorithms with game strategies has been shown recently as a methodology to improve performance and results of the optimum design procedure in aeronautical engineering and CFD problems [2], as well as in structural engineering problems [3].

Particularly, in this study we handle the use of virtual Nash evolutionary algorithms (Nash EAs) to speed up the optimization search. The minimum constrained weight optimization problem (taking into account constraints of allowable stresses and displacements) quite often considered in structural engineering, is solved using a game-theory based Nash genetic algorithm (Nash GAs). The Nash GAs procedure performance is analyzed on different sets of variable splitting of the problem on a test case problem consisting of a discrete sizing cross-section types 55 member structure and compared also with a standard panmictic evolutionary algorithm. In addition, a comparative study of several mutation rates is handled.

Numerical results of this approach of the structural test case indicate that a significant increase of performance can be achieved using the Nash strategy, both with significant advantages in algorithm robustness in finding the optimum design solution, and in convergence speed-up, illustrating the potential of Nash games for more complex engineering problems.

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