Nature Inspired Metaheuristic Optimization Algorithms and Applications

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In this work, three metaheuristic optimization algorithms, namely, the Invasive Weed Optimization (IWO) algorithm, the Imperialist Competitive Algorithm (ICA), and a hybrid between the Invasive Weed Optimization and the Particle Swarm Optimization (HIWOPSO) algorithms were investigated. The IWO Algorithm was inspired by the growth of unwanted weeds, in which an initialized random population spreads seeds and the plants survive based on fitness (B. Dadalipour, A. R. Mallahzadeh, Z. Davoodi-Rad, Loughborough Antennas and Propagation Conference, 2008). The speed and accuracy of this algorithm varied depending on certain constraints, including the maximum population and the number of seeds that existing plants can spread. The ICA works in a similar fashion as the IWO, with the initialized instances, called countries, being categorized as either empires or colonies, based on their values (E. Atashpaz-Gargari, C. Lucas, IEEE Congress on Evolutionary Computation 2007)**.** The performance of this algorithm is a function of several parameters, the most important of which are the number of colonies and empires. These two parameters had the most influence on the speed at which the algorithm operates and the ability of the algorithm to converge to an acceptable solution. The hybrid algorithm combines the Particle Swarm Optimization (PSO) algorithm serially with the IWO, thus adding another layer of optimization (Z. Hosseini and A. Jafarian, International Journal of Advanced Computer Science and Applications, 7(10), 2016).

When tested against benchmark mathematical functions, IWO and ICA generally produced the optimum results with the former exhibiting greater speed. Subsequently we compared IWO and ICA against a genetic algorithm for an array power pattern synthesis. ICA's performance in terms of convergence and speed was comparable to GA whereas IWO was found to be twice as fast as GA. In the conference we will present additional examples and results for the hybrid method.