

## A novel class of niche hybrid Cultural Algorithms for continuous engineering optimization

**Authors:** Mostafa Z. Ali and Noor H. Awad

**Abstract:** This paper proposes a novel class of niche hybrid Cultural Algorithms for solving engineering problems with continuous design variables. The first algorithm, Niche Cultural Algorithm (NCA), embeds niching within the cultural framework to maintain multiple groups within the population of agents in order to locate multiple optima. The second algorithm, hybridizes niche Cultural Algorithms with Tabu search (H-NCA). This technique offers a novel architecture of hybrid approaches, which combines Niche Cultural Algorithms (NCA) with Tabu search (TS). The proposed hybridization scheme enables the algorithm to overleap local optima and improve performance. The third algorithm, Improved Hybrid Niche Cultural Algorithms (IH-NCA), is employed to enhance convergence rate and accuracy of H-NCA with fewer computations. In IH-NCA, the algorithm switches between two selection strategies based on roulette wheel and stochastic tournament selection. This enhances the algorithm's ability to further escape stagnation and premature convergence with varying stochastic noise and selection pressure. Simulations were performed over miscellaneous engineering optimization problems that include minimization of constrained functions and structural engineering optimization. A comparative study is carried out with other state-of-the-art optimization techniques. The findings affirm the efficiency and robustness of the new methodologies over the other existing relevant approaches.