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## Multi Objective Self Adaptive Optimization Method to Maximize Ampacity and Minimize Cost of Underground Cables

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### Abstract

This study presents a novel algorithm for the optimal placement of underground cables in a concrete duct bank to simultaneously maximize ampacity and minimize cable system cost for the first time. The self-adaptive particle swarm optimization (SAPSO) method -which has been used to solve multi-objective optimization problems- is used to solve the multi-objective problem. The main novelty of this paper is finding optimal cable placement by finding maximum ampacity and minimum cable system cost, simultaneously. The proposed method is used in a test case to show how the cable placement is affected by the total ampacity and cable cost in the duct bank. The obtained results show the total fundamental ampacity decrease and the total cable cost increase, on the existence of power system harmonics. The output of the optimization problem is a Pareto optimal solution which gives the cable placement for the concurrent maximized ampacity and minimized total cost. As a case in point, at a specific ampacity of the worst cable configuration, the total cable system cost is more than the total cost of the cable configuration obtained from the optimal Pareto solution, based on simulation results.

**Keywords:** Ampacity, Current Harmonic, Multi objective Improved Self Adaptive Particle Swarm Optimization (MOSAPSO) Method, Total Cost, Underground Cables in the Concrete Duct Bank.

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