A New Accelerated Multi-objective Particle Swarm Algorithm.
Applications to Truss Topology Optimization

R. Ellaia$^1$, A. Habbal$^2$ and E. Pagnacco $^3$

$^1$LERMA, Mohammed V - Agdal University, Engineering Mohammadia School, Rabat, BP. 765, Ibn Sina avenue, Agdal, Morocco, ellaia@emi.ac.ma

$^2$J.A. Dieudonné Laboratory, Nice Sophia-Antipolis University and INRIA Sophia-Antipolis, France, habbal@polytech.unice.fr

$^3$LOFIMS, EA 3828, INSA Rouen BP 8, 76801 Saint-Etienne du Rouvray, France, Emmanuel.Pagnacco@insa-rouen.fr

**Keywords:** Topological optimization, Multi-objective optimization, Particle swarm optimization, Pareto front, matrix computation, initialization technique, Truss structures.

**Abstract.** We propose a new algorithm of computation using particle swarm in order to solve multi-objective problems more quickly and effectively. This approach, called accelerated multi-objective particle swarm, is partially based on our previous work [2] and incorporates a vector function as objective function and it uses matrix computation to develop the Pareto front. It contrast with the existing multi-objective algorithms which use an external archive[6].

For example, the study presented in [5] proposes multi-objective PSO with time variant inertia and acceleration coefficients where inertia weight and PSO algorithm parameters expressions depend to iteration number. Other study developed in [9] proposes multi-objective PSO with dynamic population size. Others studies presented in [3, 4, 8] which use hybridization technique.

Unlike all these studies which use inertia weight to develop Pareto front and an external archive to save non-dominated solution, we will modify this algorithm for causing it to use matrix computation, then this algorithm incorporates function vector as objective function and uses Pareto dominance for selecting best solutions and updating Pareto set. In addition, we also propose a new strategy of initialization that contributes too to the acceleration of the algorithm. The resulting algorithm is applied to multi-objective topology optimization of truss structures.

The results produced by such a strategy illustrate that the algorithm is competitive with NSGA-II, MISA and SPEA2 in terms of converging to the true Pareto front. It maintains the diversity of the population, generates better trade-offs and demonstrates that the matrix computation PSO can be used as a reliable numerical optimization tool.

**References**


