CEC'2025 Competition on Large-scale Multiobjective Optimization for Status Assessment of Measuring Equipment

Evolutionary algorithms (EAs) have been a popular optimization tool for decades, which have shown promising performance in solving various benchmark optimization problems. Nevertheless, using EAs on multiobjective optimization with over 100 decision variables (large-scale multiobjective optimization problems, LSMOPs) remains challenging due to the "curse of dimensionality". This phenomenon is more significant for LSMOPs in complex man-made systems, e.g., railway systems, social networks, and power systems. Specifically, EAs suffer from difficulties in dealing with enormous search space, irregularity in variable interactions and objective functions, and the existence of massive local optima for LSMOPs in emerging and critical applications. Existing optimization algorithms may cost unbearable function evaluations (FEs) and computation time (time complexity) to obtain acceptably converged/diverse results. Unfortunately, this phenomenon is more serious when the number of decision variables increases from large scale (>100) to super large scale (>1,000,000), where the limitation in storage memory rises due to the increased space complexity. Both time and memory efficiency, as well as search effectiveness, should be considered when dealing with large-scale multiobjective optimization problems, for filling the gap between complex real-world optimization and advanced optimization algorithms.



Figure 1 The IEEE 30-node standard topology for OSA-IT problems.

In this competition, we carefully format three SSMOPs from one interesting real-world application: online status assessment of instrument transformers in wide-area power systems (OSA-IT). The IEEE 30-node standard topology, refer to Figure 1, with a time-varying workload is modelled and simulated to obtain measured data of the system, aiming to assess the status of instrument transformers. Generally, the time-varying voltages, currents, and system-level parameters are formatted as decision variables, the differences between the estimated results and physical rules of the system are modelled as the objectives. Three OSA-IT problems with *1 million*, *10 million*, and *100 million* decision variables are given in this competition (the detailed descriptions will be given in the competition website). As an extension of the TREE test suite, this competition is expected to promote the research in smart grid and advanced optimization algorithms, and to explore some potential research directions for super large scale optimization, especially for the community of computational intelligence.

Participants are encouraged to develop the algorithm to solve this type of optimization problem, not just a specific one of them. Participants may propose a new optimization algorithm or utilize a hybrid form of previously proposed algorithms. Remarkably, it is not restricted in the field of evolutionary computing, and using commercial optimization software is allowed. **Participants are required to submit their own source codes, a brief description of the optimization algorithm, and a brief code instruction**. Organizers will carry out the performance evaluation of your proposed algorithm in all three problems to guarantee its fairness. With the same computational budget, the best solution of each problem obtained by running your algorithm 1 time will be compared directly.

**Sponsor:**

An award funding of USD 500 will be applied from the IEEE CIS Education Competition Subcommittee.

**Organizers:**

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