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A NEW DYNAMIC MULTI-OBJECTIVE OPTIMIZATION EVOLUTIONARY ALGORITHM

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Abstract. *Dynamic multi-objective optimization problem (DMOP) often involves incommensurable, competing and varying objectives with time (environment), and the number of their Pareto optimal solutions is usually infinite, thus how to find a sufficient number of uniformly distributed and representative Pareto optimal solutions at any environment for the decision maker is very important. In this paper, we divide the time period of DMOP into several equal subperiods. In each subperiod, the DMOP is approximated by a static multi-objective optimization problem (SMOP). Furthermore, the static rank variance and the static density variance of the population are defined, by using the static rank variance and the static density variance of the population as two objectives, each SMOP is further transformed into a bi-objective optimization problem. As a result, the original DMOP is approximately transformed into several static multi-objective optimization problems. Thereafter, an environment changing feedback operator which can automatically check out the environment variation is proposed and an improved non-uniform mutation operator with quantization is designed. Based on these, a new dynamic multi-objective optimization evolutionary algorithm (denoted by DMEA) is proposed. The comparative study shows that DMEA is more effective and can find better solution set in environment-varying than the compared algorithms can in terms of convergence, diversity, and the distribution of the obtained Pareto optimal solutions.*
Keywords: Dynamic optimization, Multi-objective optimization, Evolutionary algorithm, Pareto optimal, Uniform distribution

1. **Introduction.** Many real-world problems naturally fall within the purview of optimization problems, in which the objective function and constraint or the associated problem parameters or both vary with time (environment), so the optimum solutions of these problems also vary with the change of environment. This kind of optimization problems is called dynamic optimization problem (DOP) [1-3].

DOP includes dynamic single-objective optimization problem (DSOP) and dynamic multi-objective optimization problem (DMOP). When considering DSOP, the use of evolutionary algorithm (EA) for a environment-dependent fitness landscape has been considered, and several approaches are reported in the literature, such as maintaining diversity during the run via random immigrants [3], increasing diversity after a change of the environment [4], using memory schemes to reuse old good solutions [5], and multi-population approaches [6].