ADAPTABILITY OF MULTIRECOMBINATED EVOLUTIONARY ALGORITHMS TO CHANGING COMMON DUE DATES

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ABSTRACT

In the restricted single-machine common due date problem [1, 3, 10, 12] the goal is to find a schedule for the *n* jobs which jointly minimizes the sum of earliness and tardiness penalties. This problem, even in its simplest formulation, is an NP-Hard optimization problem [4].

New trends to enhance evolutionary algorithms introduced *multiple-crossovers-on-multiple-parents* (MCMP) a multirecombinative approach [5, 6, 7, 8, 9] allowing multiple crossovers on the selected pool of (more than two) parents. MCMP-V is a novel MCMP variant, which directly applies multirecombination to the Lee and Kim [11] approach using uniform scanning crossover.

The main objective of this new recombinative method is to find a balance between exploration and exploitation in the search process. Recent results are promising and showed the potential of this method by finding new optimal solutions for smaller instances and improving the upper bound in the larger instances, extracted from the OR-Library, of the common due date scheduling problem

An evolutionary algorithm usually starts from a randomly generated initial population and its performance is expected to be better if some good solutions (seeds) are inserted in this initial population. Regrettably this cannot be guaranteed because premature convergence can happen if exploitation and exploration are not adequately balanced.

In a production process common due dates are prone to change according to systems requirements.

This work shows how MCMP-V can adapt itself to this changes in requirements: Taking the final population of an evolutionary process for a given common due date as the initial popula-

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tion of another evolutionary process for a distinct common due date provides optimal or near optimal solutions in few generations.

Experiments were conducted by randomly choosing a final population evolved for a given common due date as the initial population for the same evolutionary algorithm with a modified common due date. The algorithm was tested on problems size of 10, 20 and 50 jobs extracted from the Beasley [2] benchmark and run 10 times for each instance. Results indicated that speed of convergence is achieved without falling in local optima.

For instance, in 10 and 20 jobs problems size the number of generations to find the best individual is reduced in 40% in average without loss of quality in the results. For 50 jobs problems size the number of generations required is reduced in at least 80% in average and quality of results is degraded in less than 1%.

This property implies an economy of computational effort to support changes in system requirements, because previous findings (schedules) for different common due date requests can be stored in the system as a knowledge base to be used in the future for provision of fast response.

Details of implementation and results will be discussed.

Keywords: Evolutionary Algorithms, Single Machine Scheduling, Multirecombination , Common due date, Problem.

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