A COMPARISON OF TWO V-SHAPED SCHEDULE-BUILDER EAs FOR THE COMMON DUE DATE PROBLEM

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ABSTRACT

The restricted single-machine common due date problem [1, 2, 4, 5, 12, 15] can be stated as follows: A set of n jobs with deterministic processing times p_i and a common due date d are given. The jobs have to be processed on one machine. For each of the jobs an individual earliness α_i and tardiness β_i penalty is given, which is incurred, if a job is finished before or after the common due date d, respectively. The goal is to find a schedule for the n jobs which jointly minimizes the sum of earliness and tardiness penalties. Even simple in the formulation, this model leads to an optimization problem that is NP-Hard [5].

According to [16] an optimal schedule for this problem is V-shaped around the due date. That means that those jobs that are completed on or before the due date are processed in nonincreasing order of p_i/α_i and those that are started on or after the due date are processed in nondecreasing order of p_i/β_i.

Evolutionary algorithms have been successfully applied to solve scheduling problems. Lee and Kim [13] proposed a binary representation for a genetic algorithm which guarantees that all chromosome represents V-shaped schedules.

To balance exploration and exploitation in the search space [14] new trends to enhance evolutionary algorithms are oriented to multirecombination [6, 7, 8, 9, 10, 11]. MCMP (*multiple-crossovers-on-multiple-parents*) is a novel multirecombinative approach allowing multiple crossovers on the selected pool of (more than two) parents.

The use of a breeding individual (stud) which repeatedly mates individuals that randomly immigrates to a mating pool can further help balance between exploration and exploitation. Under this approach the random immigrants incorporate exploration (making unnecessary the

[1] The Research Group is supported by the Universidad Nacional de La Patagonia Austral.
[2] The LIDIC is supported by the Universidad Nacional de San Luis and the ANPCYT (National Agency to Promote Science and Technology).

use of mutation operations) and the multi-mating operation with the stud incorporates exploitation to the search process.

This work describes implementation details and the compared performance of two multirecombinated variants, MCMP-V and MCMP-SRI, which build v-shaped schedules. MCMP-V directly applies multirecombination to the Lee and Kim approach using uniform scanning crossover. MCMP-SRI, applies multirecombination between studs and inmigrants using uniform crossover. Both variants were tested, for a set of single machine scheduling instances [2] with a common due date. Their effectiveness is demonstrated by improved upper bounds obtained.

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

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