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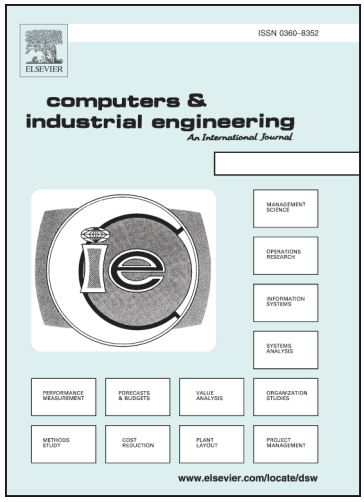

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Scheduling Multiple, Resource-Constrained, Iterative, Product Development Projects with Genetic Algorithms

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ABSTRACT

Many product development (PD) projects rely on a common pool of scarce resources. In addition to resource constraints, there are precedence constraints among activities within each project. Beyond the feed-forward dependencies among activities, in PD projects it is common for feedback dependencies to exist that can result in activity rework or iteration.

In such a multi-project, resource-constrained, iterative environment, this paper proposes two new genetic algorithm (GA) approaches for scheduling project activities. The objective is to minimize the overall duration of the portfolio of PD projects. These proposed GAs are tested on sample scheduling problems with and without stochastic feedback. We show that these algorithms provide quick convergence to a globally optimal solution.

Furthermore, we conducted a comparative analysis of the proposed GAs with 31 published priority rules (PRs), using test problems generated to the specifications of project, activity, and resource-related characteristics such as network density (complexity), resource distribution, resource contention, and rework probability (amount of iteration). The GAs performed better than the PRs as each of these factors increased. We close the paper by providing managers with a decision matrix showing when it is best to use the published PRs and when it is best to use the GAs.

Keywords: Resource-Constrained Project Scheduling Problem (RCPSP), Resource-Constrained Multi-Project Scheduling Problem (RCMPSP), RCMPSP with Feedback (RCMPSPwF), Iteration, Rework, Design Structure Matrix (DSM), Genetic Algorithm (GA).

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