A GA Based Approach for Dynamic Job-Shop Scheduling Problems

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Most research in Genetic Algorithms (GA) focuses on optimisation of static scheduling problems. Since Davis proposed the first Genetic Algorithm to address scheduling problems in 1985, GA have been widely used in manufacturing scheduling applications. However, most of he works deal with optimisation of the scheduling problem in static environments, whereas many real world problems are dynamic, frequently subject to several sorts of random occurrences and perturbations, such as random job releases, machine breakdowns, jobs cancellation and due date and time processing changes.

Due to their dynamic nature, real scheduling problems have an additional complexity in relation to static ones. In many situations these problems, even for apparently simple situations, are hard to solve, i.e. the time required to compute an optimal solution increases exponentially with the size of the problem. GAs have been extensively used in the context of Job-Shop Scheduling Problems (JSSP). If all jobs are known before processing starts the JSSP is called static, while if job release times are not fixed at a single point in time, i.e. jobs arrive to the system at different times, the problem is called dynamic. Scheduling problems can also be classified as deterministic, when processing times and all other parameters are known and fixed, and stochastic, when some or all parameters are uncertain.

The proposed approach deals with these two cases of dynamic scheduling: deterministic and stochastic. For such class of problems, the goal is no longer to find a single optimum, but rather to continuously adapt the solution to the changing environment. The purpose of this paper is to describe an approach based on GA for solving dynamic scheduling problems, where the products (jobs) to be processed have due dates. This paper starts by presenting a scheduling system, based on Genetic Algorithms for the resolution of the dynamic version of Single Machine Scheduling Problem (SMSP). The approach used adapts the resolution of the static problem to the dynamic one in which changes may occur continually. This takes into account dynamic occurrences in a system

and adapts the current population to a new regenerated population. Then, it is proposed an approach for the resolution of the Job-Shop Scheduling Problem (JSSP) in dynamic environments.

Key words: Scheduling, Dynamic Scheduling, Genetic Algorithms.