Abstract

The flowshop problem emerges about 60 years ago as an approximation to some manufacturing industrial processes, more precisely to scheduling problems. Scheduling refers to the problem of finding an order to pending production tasks on a manufacturing industry. After so much study in the past years, today there is still a great gap between theorical problems and the reality of industrial enterprises.

One of the most relevant differences is the fact that when solving a real life scheduling problem it is usual to have in mind more than one objective, i.e. to finish the production as soon as possible, and at the same time to maximise the use of resources an also to meet customer due dates. In this context multi-objective problems started to show their relevance.
In the las 20 years multi-objective flowshop problems have seen a great development, diminishing the existing gap between theorical and real life problems.

In this thesis we present a review of some multi-objective flowshop problems, starting with more basic problems and advancing to more complex and more realistic problem settings.
This work also has other objectives. One of the issues that are frequently ignored in multi-objective optimization is the correct measurement and comparison of multi-objective results. We will present a review of the some of the most used methods, pointing out the problems and advantages of each one, with the

final objective of obtaining a valid, clear, consistent and sound methodology for the comparison of multi-objective problem results.

To begin with our work in the multi-objective flowshop problem, we will propose a task never carried out before: the implementation and experimental comparison of 23 multi-objective algorithms. Some of them where proposed for solving the multi-objective flowshop problem and others are of general purpose. This will give us deep knowledge about different methodologies proposed for solving multi-objective problems. As a result of all this implementation and experimentation work we will understand methodologies from genetic algorithms, tabu search, ant colony optimization to simulated annealing, etc. All this will allow us to see the advantages an disadvantages of each proposed method and to determine their strengths and weaknesses, thus we can finally propose a competitive, fast and effective general purpose algorithm for solving multi-objective problems.

This review of different flowshop problems will allow us to know the state-of-the-art of the literature and at the same time to get closer to real life problems. In each step we will study more complex problems, analyzing and comparing existing methods against our own proposed one. In order to achieve this we will start from the multi-objective permutation flowshop problem, then we widen this problem by adding sequence dependent setup times, and finally we will study the multi-objective hybrid flowshop problem.