A two-stage methodology for short-term batch plant scheduling : Discrete-Event Simulation and Genetic Algorithm

Catherine AZZARO-PANTEL, Leonardo BERNAL-HARO, Philippe BAUDET*,
Serge DOMENECH, Luc PIBOULEAU
Laboratoire de Génie Chimique - UMR CNRS 5503
ENSIGC INPT
18, Chemin de la Loge
F-31078-Toulouse Cedex - FRANCE
Tél : +33 (0)5 62 25 23 73
Fax : +33 (0)5 62 25 23 18
* Author to whom all correspondence should be addressed

Abstract

In this paper, a two-stage methodology for solving jobshop scheduling problems is proposed. The first step involves the development of a discrete-event simulation (DES) model to represent dynamically the production system behavior, taking into account the main features inherent to the application field. Since most scheduling problems in batch processing belong to the family of problems classified as NP-complete, probabilistic optimization algorithms (simulated annealing, evolutionary algorithms…) represent a good alternative for solving large-scale combinatorial problems (for instance, traveling salesman problem). In the second step of our approach, we thus investigate Genetic Algorithms (GAs) for solving batch process scheduling problems: a GA has been developed for minimizing the average residence time to produce a set of batches in function of batch order in a multipurpose-multiobjective plant with unlimited storage. The evaluation of the objective function is provided by its coupling with the DES model embedded in the optimization loop. Computational results show that the use of this approach can significantly help improving the efficiency of the production system. This paper is focused on semiconductor application, which is the first example treated in our laboratory, but the general approach adopted in this study is now extended to other fields of applications (e.g. fine chemistry with finite intermediate storage and unstable intermediates).

Keywords : batch plant - scheduling - semiconductor manufacturing - discrete-event simulation - optimization- Genetic Algorithm.