SYSTEM OF SCHEDULING FOR MIXED ASSEMBLY LINES IN A JUST IN TIME ENVIRONMENT

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Abstract: Mixed model assembly lines can be found today in many industrial environments. Based on the problematic of knowing the optimal sequence in which each lot in an assembly line is going to be produced, this research considers a design to simulate a meta heuristic algorithm to obtain the optimal sequence that takes into account the maximization of the production lines capacity as well as in the use of components and other programming criteria. The methodology considered for the analysis was GRASP (Greedy Randomized Adaptive Search Procedures). A heuristic that minimizes the time of programming and allows the assembly lines to be scheduled in a real time. Based on feasible data, the obtained results of such simulation allow concluding that the lines of production were working in an optimal sequence.

Keywords: GRASP, Optimal, Metaheuristic

1. INTRODUCTION

A pull system (Jonathan and Thomas, 2000) is applied in plants of flexible production: the production area receives the requirements through the marketing department in order to program these requirements, upwards considering that the balance of the line (distribution of tasks in every station) is made on values of load average from the times of process of the specific tasks of each product and the mixture of production (YuanhuI *et al.*, 2000).

Considering the time of cycle as a reference during the process of production, it is reasonable to suppose under such conditions that the form to schedule products in the productive system might generate undesirable overload of work. The concept of optimal sequence appears in this part of the production process and is linked to how the launching of the lots of different products from the lines must be ordered, so, that the required times to complete the tasks assigned to each station are adjusted the best as possible along with the cycle of time. The meta-heuristics procedures are a kind of approximate methods designed to solve out difficult problems of combinatorial optimization in contrast with the classic heuristic ones, which are not effective or efficient at all, the meta-heuristic methods provide a general frame to create new hybrid algorithms.

The aim of this article is to find out the optimal sequence of the lots based on the meta-heuristic

algorithm GRASP (Greedy Randomized Adaptive Search Procedure). The present investigation is organized as follows: in chapter two are reconsidered the main concepts of GRASP, chapter three the formulation of the problem is meticulous reviewed, chapter four appears a comparative table between the GRASP algorithm and its adaptation to this issues. The pseudo-code of the generated algorithm is presented, chapter five the simulation of the algorithm is explained and the results obtained with the simulation of the algorithm using feasible data are shown.

2. GRASP METHODOLOGY

GRASP is an iterative procedure of where each step consists of a phase of construction and another one of improvement(Thomas and Mauricio, 1995). In the phase of construction a constructive heuristic procedure is applied to obtain a good initial solution. This solution is improved in the second phase by means of a local algorithm search. The best of all the examined solutions goes on as a final result. Function of the algorithm Greedy:
greedy(C: candidatesSet; var S: solutionSet);
while(C diferrent 0) and not solution (S) Do x:= select (C);
x element of C C:= C - {x};
if (S or {X} is feasible then
S = S u {X}
insert(S , x);
end while
if not solution(S)
then return "There are no a solution founded"

3. PROBLEM

The problem is usually present in the assembly lines where the variety of products and small lots prevail and the setup is constant. In the following section the objective and the criteria under which this algorithm was made is explained.

3.1 General Description

The plants of world-wide class that work just in time producing to certain taktime have the task of scheduling the sequence in which their commands will be produced under specific scheduling criteria. Nowadays few plants have developed applications and many of them carry out that sequence based on the experience or by felling. Sometimes these commands programming are affected by unforeseen expenses leading to reprogram the sequence causing waste of time as a result. In table 1 the problematic is exposed. From this input of orders

Table 1. Orders Received from clients

Pieces	Customer	Due Date
220 of A	Customer 1	Thuesday
330 of B	Customer 3	Thursday
550 of C	Customer 1	Wednesday
1000 of A	Customer 2	Monday
2000 of B	Customer 1	Thursday
...	...	...
N of X Product	Customer N	X Date(d/m/y)

it is expected an optimal scheduling, these are the necessary elements for the programming. The N pieces begins from 1 up to n pieces in which $0 < N <= n$ each piece can be processed in some of the lines available with different taktime, the M machines begin from 1 to n machines. $0 < M <= n$ the I lots begin from 1 in which $0 < I <= n$, a lot consists of products of the same variety or model and have a defined size. The L assembly lines begin from 1 up to n lines $0 <= L <= n$ each line will be composed of n machines. Each line will be processing product according to the products that have been previously configured. The products will be processed in one line according to the correspondence of similar operations. The components will be used according to their availability and all the lines will not use all the components at all. The component C can begin from 1 to n component $0 < C <= n$ taktime is the rate of production of each one products. Thus, taktime will depend on the demand that generate the customers. The time of PTP process will be unique for each product and it will represent the total time of process for one piece. The shifts will began from one shift to N shifts and will have a beginning and conclusion.

3.1.1. Criteria of scheduling The criteria of scheduling to choose the lots are:

- Due date of the orders (the policy is "make to order")(Joseph *et al.*, 2002).
- The first lot will be assigned for the one that posses the greatest priority along the due date.
- The capacity available of production of n line.
- The availability of components to satisfy the orders.
- The quantity of lots that can be scheduled are planned for one week of production.

This does not limit to program several weeks of production.

The periods considered in the algorithm are:

- Time of preparation (setup).
- Time of change of tools (changeovers).
- The transference time from one station to another (Distance between machines if they exist).