SCHEDULING ALGORITHM FOR LOT MOVEMENT IN SEMICONDUCTOR WAFER FABRICATION

A Thesis submitted to the Graduate School in partial fulfillment of the requirements for the degree
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ABSTRACT

Dynamic scheduling for semiconductor wafer FAB is necessary in a complex semiconductor manufacturing environment. An effective material handling scheduling is important in order to avoid tool sits idle waiting for the lot delivery, which resulting in a longer cycle time. Two primary approaches to the scheduling problem in the semiconductor wafer fabrication industry, which are heuristic rules and Artificial Intelligence (AI) optimization method, are discussed. Imitating the collective activities of ant colonies, an approach to constructing pheromone-based scheduling algorithm using Ant Colony Optimization for lot movement in semiconductor wafer fabrication process is propose to be implemented in SilTerra Malaysia.

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Norzieyuswati Md Zenal.

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CHAPTER 1

INTRODUCTION

Today's semiconductor companies are looking forward to stay ahead of the competition in cost and speed. Companies aim to reduce cycle time in order to meet promised delivery dates, while maintaining the high capacity utilization required to remain profitable. In the present semiconductor market, shortening the cycle time, raising the throughput rate and on time delivery rate becomes more and more important for the reason of competition. The entire above give high request for dynamic scheduling in semiconductor wafer fabrication.

Semiconductor wafer fabrication is one of the most complex manufacturing processes. Semiconductor wafer fabrication is complex with its unique characteristics, such as reentrant product flows, diverse types of equipment, complex production processes, unpredictable yield and equipment downtime. All of these factors make production planning and scheduling complicated. Hence, effective shop floor scheduling is essential to control the cycle time in ensuring timely deliveries (Upasani *et al.*, 2006).

Scheduling policies attempt to get the right products done at the right time. According to Bixby *et al.* (2006) all schedulers in semiconductor wafer fabrication process area share five common objectives and data requirements. The first is to maximize urgent lot

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```
1./* Initialization phase */
For each pair (r,s) τ(r,s):= τ_0 End-for
For k:=1 to m do
Let r_k1 be the starting city for ant k
J_k(r_k1):= {1, ..., n} - r_k1
/* J_k(r_k1) is the set of yet to be visited cities for
ant k in city r_k1 */
r_k:= r_k1 /* r_k is the city where ant k is located */
End-for
2. /* This is the phase in which ants build their tours. The tour of
ant k
is stored in Tour_k. */
For i:=1 to n do
If i<n
Then
For k:=1 to m do
Choose the next city s_k according to Eq. (3) and Eq. (1)
J_k(s_k):= J_k(r_k) - s_k
Tour_k(i):=(r_k ,s_k)
End-for
Else
For k:=1 to m do
/* In this cycle all the ants go back to the initial city r_k1 */
s_k := r_k1
Tour_k(i):=(r_k ,s_k)
End-for
End-if
/* In this phase local updating occurs and pheromone is
updated using Eq. (5)*/
For k:=1 to m do
τ(r_k ,s_k):=(1-ρ)τ(r_k ,s_k)+ ρτ_0
r_k := s_k /* New city for ant k */
End-for
End-for
3. /* In this phase global updating occurs and pheromone is updated */
For k:=1 to m do
Compute L_k /* L_k is the length of the tour done by ant k*/
End-for
Compute L_best
/*Update edges belonging to L_best using Eq. (4) */
For each edge (r,s)
τ(r_k ,s_k):=(1-α)τ( r_k ,s_k)+ α(L_best)-1
End-for
4. If (End_condition = True)
then Print shortest of L_k
else goto Phase 2
```