Journal of the Society of Korea Industrial and Systems Engineering
Vol, 27, No. 3, pp.37－44, September 2004.

A Study on Weighted Composite Dispatching Rule in the Modular Production System

Kwang-Mo Yang* · Jae-Hyun Park** · Kyong-Sik Kang***

*Industrial Engineering, Graduate School, Myongji University
**Industrial Systems & Engineering, Seoil College
***Industrial Engineering, Myongji University

모듈생산시스템에서의 가중 혼합 할당규칙 연구

양광모* · 박재현** · 강경식***

*명지대학교 산업공학과 박사과정
**서일대학 산업시스템경영과 초빙교수
***명지대학교 산업공학과 교수

국내 반도체 산업은 불과 20년도 안되는 짧은 기간동안에 괄목할만한 성장을 하여 전세계 반도체 생산 규모 면에서 3위 국가로 부상하였으며, 기술 경쟁력 면에서도 한국인의 자존심을 그나마 지켜왔다. 하지만, 반도체 제조는 가장 복잡한 제조공정의 하나로 분류되며, 이러한 복잡한 시스템을 통제하기 위해서는, 다양한 시스템 조건하에서 적절한 생산전략을 마련하는 것이 필요하다. 그러나, 반도체 제조 시스템에 대한 다양한 상황과 관련한 연구는 많지 않다. 반도체 제조공정 시스템에 대한 스케줄은 생산공정의 재진입, 공정의 높은 불확실성, 급속하게 변하는 제품과 기술과 같은 특성 때문에 반도체 제조공정 시스템에 대한 스케줄은 복잡하고 어려운 작업이며, 사이클타임의 절감 및 단위시간당 생산량의 증대와 같은 시스템 목적을 달성하기 위하여, 반도체 제조 시스템에 대한 좋은 방법을 발견하기 위한 많은 연구가 있었다. 반도체 산업의 생산 흐름은 가장 독특한 특징을 가지고 있으며 생산계획과 반도체 제조의 스케줄링과 계획을 어렵게 하고 있다. 현재 반도체 조립공정에서 수행되고 있는 일정계획은 단순 FCFS (First Come First Serve)에 의한 할당규칙에 따른다. 또한 Backlog(예비재고)를 1일 생산량을 기준으로 Buffer로 운영하고 있다. 따라서 본 연구에서는 효율적인 재고관리와 정확한 스케쥴링이 생산의 경쟁력 확보 우위임을 가정하여 다양한 할당규칙(dispatching rule)을 실시간 적용하여 정확한 일정계획 수립의 효과와 결과를 시뮬레이션을 통해 검증하고자 한다. 제시된 방법론을 위하여 시뮬레이션 접근방법이 사용되었다.

Keywords : semiconductor modular process, AHP (Analytic Hierarchy Proces weighted composite dispatching rule

1. Introduction

The production of semiconductor wafer is classified as one of the most complex manufacturing processes. In order to control this complex system, we should determine appropriate dispatching rules under various system conditions. Dispatching rules are classified into two classes: vehicle-initiated and machine-initiated dispatching rules. Both of these are essential for improving the system performance, especially in relation to the real-time control system. However, there are not many studies under various situations for semiconductor manufacturing system. Furthermore, there is no single dispatching rule that is always appropriate for all situations. Therefore, this study was carried out to develop the schedule for selecting the dispatching rule for decision making factors in order to obtain the performance criteria demanded by users during each production interval. The current scheduling carried out in the semiconductor assembly process follows the dispatching rule by simple FCFS (First Come First Serve). In addition, the buffer of backlog is based on the output for one day. Accordingly, assuming that the keys to securing competitive production capability are efficient inventory management and accurate scheduling, this study applied various dispatching rules in real time to prove the effects and results of accurate scheduling through simulation. The simulation approach was used for the presented methodology.

2. The reference situation

Baek et al. (1998) suggested a dispatching rule for each machine using Taguchi experimental design and simulation. The appropriate dispatching rule for each machine is determined on the basis of the machine's status, and the relevance is determined through repeated simulations, while the Taguchi experimental design discovers a series of effective weight standards. The results showed that the SAP method reduces the average cycle time more than applying a single decision making rule to all machines. Nakata et al. (1999) described the work flow regulation for multiple productions called JUSTICE/MORAL [63]. This JUSTICE/MORAL method dynamically searches bottleneck equipment and distributes tasks at the right time. This method first finds candidate bottleneck equipment and determines appropriate distribution when the combination of production changes. Moreover, before each equipment, it calculates appropriate WIP quantity in real time. This method matches the bottleneck conditions for all equipment in the line, and controls the progressing speed of all lots. The results of this experiment showed that compared to FCFS, the cycle time decreased by 13% on average, and the output increased by about 10%. Lin et al.(2001) studied the effects of the dispatching rule means and policies for wafer production using simulation. This simulation model includes the automated double loop interbay in the wafer production. The simulation results showed that the dispatching rule influenced equally to the usage rate of transportation equipment, material processing volume, queuing time, and average transportation time. The shortest distance with the nearest transportation equipment and the combination of FCFS surpassed other rules. However, the study of Lin et al (2001) considered only the dispatching rule of transportation system without any regard to the dispatching rule of machines. Most schedule researches including the old ones are related to the dispatching rule based on machines only. However, there is few researches focused on the combination of the two under various situations. Furthermore, the scheduling carried out in the current semiconductor assembly process follows the dispatching rule by simple FCFS. Therefore, this study tries to prove the effects and results of accurate scheduling through simulation by applying various dispatching rules in real time

3. System analysis for present

3.1 Present system conditions

M Company manufactures the semiconductors for the modular production system with assembly process module lines.

<Table 1> Number of equipment in the Module

process	Process Name	Equipment Name	Num. of Equipment	utilization (%)
10	Wafer Mount	ATM 8100	6	0.92
20	Die Saw	DFD 640	6	0.93
30	Die Attaching	LM 400	8	0.90
		ESEC-2006	8	0.93
40	Wire Bonding	UTC 250	44	0.96
50	Mold Dieing	UPS 80N	12	0.94
60	Marking	CO2 MARK	2	0.96
		LASER MARK	2	1.00
70	Cureing	BLUE-M POM7	2	0.99
		ASC 336	2	0.98
80	Trimming	AUTO DIE	2	0.94
		MECH-PRESS	2	0.95
90	Plating	SP TECH MACH.	4	0.98
100	Forming	FORM SING.	4	0.93
		MECH-DIE	2	0.95
110	Inspection	EVI L/A	4	0.98
120	Packing			

The number of equipment and the rate of operation for each module are shown in table 1, and other information on the basic assembly process is shown in table 2, table 3 and table 4. The following tables are used as basic information for simulating the assembly process modules of M Company.

The assumptions of simulation based on the actual data of M Company are: (1) For assembly process, considering the characteristics of semiconductor processes, the wafers are regarded as raw materials and deployed to the process according to sales orders without any loss of the raw materials, (2) Although the WIPs (work in process) are generated by delayed work and equipment faults during the process, it is assumed that there is no actual WIP with the deployment of many identical work machines, (3) The raw material stocks are refilled progressively or temporarily, daily or weekly as shown in table 3, and (4) The line setup times between products are as shown in table 4.

<Table 2> Average setup time and processing time

Num	Process Name	Setup time(Min)				Processing time(Min)			
		16M	64M	128M	256M	16M	64M	128M	256M
10	Wafer Mount	6	6	6	10	66	66	66	112
20	Die Saw	10	6	6	10	66	60	60	120
30	Die Attaching	20	20	20	25	264	212	192	200
40	Wire Bonding	30	30	30	30	260	240	192	168
50	Mold Dieing	15	15	15	15	210	160	160	160
60	Marking	10	10	10	10	156	144	144	144
70	Cureing	5	5	5	5	300	300	300	300
80	Trimming	15	15	15	15	120	100	80	80
90	Plating	10	10	10	10	198	188	188	188
100	Forming	25	25	25	25	222	100	100	100
110	Inspection	5	5	5	5	66	30	30	30
120	Packing								

<Table 3> Inventory record

Inventory	refill	application
Wafer	requirement lot	150 roll / 1 week
UV-Tape	50 roll	150 roll / 1 week
Die Attacher	500,000 ea	750,000 ea / 1 day
Diamond Wheel	20 ea	50 ea / 1 week
Capillary	100 ea	100 ea / 1 week
Gold Wire	10 roll	20 roll / 1 week

<Table 4> The line setup times

setup time	16 M	64 M	128 M	256 M
16 M	0	40	80	100
64 M	40	0	50	90
128 M	80	50	0	60
256 M	100	90	60	0
LOT SIZE	5,000 EA	2,500 EA	2,500 EA	2,500 EA

Under the above assumptions, as the biggest characteristic of the assembly process before starting the simulation, the equipment deployed in modules #1 and #2 cannot be exchanged, but follows the Work Pair rule by which they can work only with the specified machines. The curing process of module #7 has a fixed time (5 hours at 175) with the work standard of 10 lots for one time performance regardless of the product. Furthermore, the current scheduling problem of M Company is that with FCFS for sales profits they work in the order prescribed by the sales department, and allow a backlog of 1 day for scheduling.

3.2 Performance indices for simulation

The performance indices that provide the basis for selecting one scheduling has important meaning from the manager's viewpoint. In order to achieve the overall goals of your organization, you have to establish a scheduling that can fulfill the performance indices from the management viewpoint. The following are the indices used for this study:

① Total production time

The maximum completion time, which is also called make span. For example, in the case of flow production, when a lot consists of n tasks, the time when the nth task finishes is the total production time. A shorter total production time is better.

② Average tardiness

The average delay time of the delayed processes. The shorter the better.

③ The number of tardy jobs

The number of tasks that did not observe the due date. The fewer the better.

④ Total setup time

The total setup time required for a task. The shorter the better.

⑤ utilization rate

The rate of time used for actual work out of the operation time for one machine. When we expand this to the entire machines, it becomes the average machine utilization. The higher this index is, the better it is. In this study, we analyzed the utilization of ATM8100 in the process #10, DFD-640 in the process #20, and BLUEMP7 & ASC336F in the Curing process, which are the most problematic of the studied processes.

<Table 5> Production order for FCFS

order_number	quantity	due_date
TFD16-01-01	100000	2003/11/30 00:00:00
TFD256-04-02	20000	2003/12/15 00:00:00
TFD128-03-03	80000	2003/11/20 00:00:00
TFD128-03-04	60000	2003/12/10 00:00:00
TFD16-01-05	15000	2003/11/15 00:00:00
TFD256-04-06	250000	2003/12/30 00:00:00
TFD64-02-07	10000	2003/11/15 00:00:00
TFD64-02-08	40000	2003/11/20 00:00:00
TFD16-01-09	20000	2003/12/05 00:00:00
TFD64-02-10	70000	2003/12/15 00:00:00
TFD128-03-11	50000	2003/11/20 00:00:00
TFD256-04-12	60000	2003/11/15 00:00:00
TFD16-01-13	100000	2003/12/15 00:00:00
TFD128-03-14	200000	2003/12/20 00:00:00
TFD64-02-15	120000	2003/11/30 00:00:00

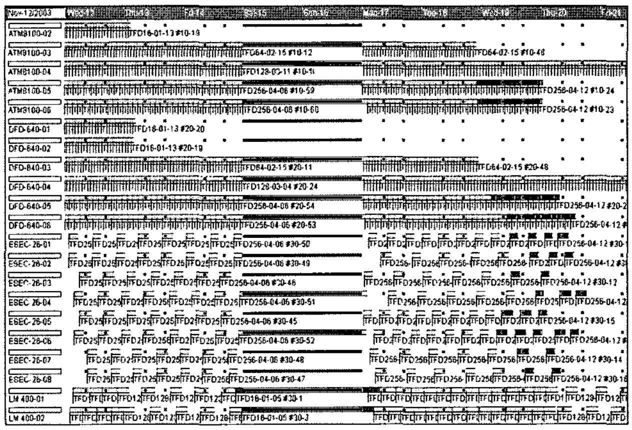
<Table 6> Simulation statistics result

performance index	FCFS	EDD	SPT
Total production time	23.47 days	18.17days	12.81days
Total setup time	258.27hours	316.35hours	289.10hours
The number of tardy jobs	9 unit	6 unit	3 unit
Average tardiness	15.77 days	8.23 days	7.77 days

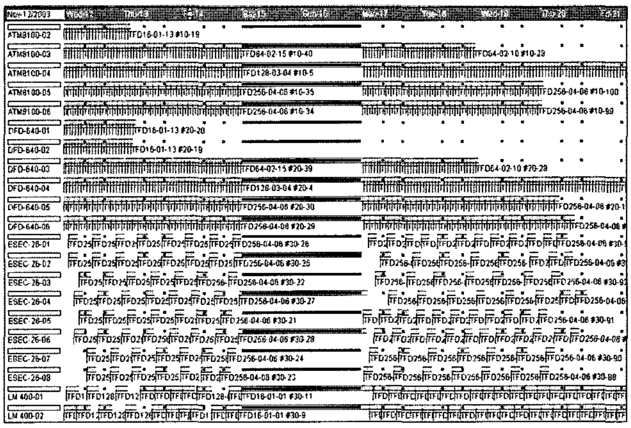
<Table 7> Equipment utilization

process	equipment	utilization(%)		
		FCFS	EDD	SPT
10 process	ATM8100-01	19.84	19.89	19.65
	ATM8100-02	19.23	19.28	19.04
	ATM8100-03	82.01	82.06	81.82
	ATM8100-04	100.00	100.00	100.00
	ATM8100-05	100.00	100.00	100.00
	ATM8100-06	100.00	100.00	100.00
20 process	DFD-640-0	20.56	20.61	20.37
	DFD-640-0	19.40	19.45	19.21
	DFD-640-0	80.53	80.58	80.34
	DFD-640-0	89.06	89.06	89.08
	DFD-640-0	100.00	100.00	100.00
	DFD-640-0	100.00	100.00	100.00
Cureing process	ASC336F-01	87.23	88.56	88.10
	ASC336F-02	87.91	88.72	88.07
	BLUEMP-01	55.90	73.87	90.08
	BLUEMP-02	58.54	68.92	79.56

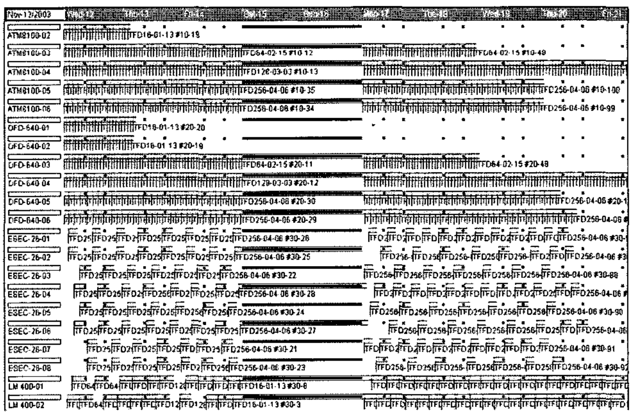
The production order for one day according to the decision making of the Sales Department based on the basic process information in Section 3.1 is shown in table 5. This order is the FCFS order for simulation. The current production types of M Company according to the simulation results are shown in figure 1, figure 2, and figure 3. In addition, the statistical analysis of the simulation results are shown in table 6 and table 7.



<Figure 1> Simulation result for FCFS



<Figure 2> Simulation result for EDD



<Figure 3> Simulation result for SPT

4. Design and application to Weighted composite dispatching rule

4.1 Weighted composite dispatching rule

In Chapter 3, we have examined each dispatching rule. According to the characteristics of M Company, they cannot flexibly cope with irregular customer orders and frequent process changes with only one dispatching rule. However, under the present circumstances, because consistent process tasks are allocated with the weight given to profits, there is the problem of generating orders in the descending order of profits with the backlog of 1 day. This study used the weight of EDD (earliest due date) by considering the Penalty and Price for due date, and calculated the weight of SPT (shortest process time) by reflecting the process run time to study on the composite dispatching rule. The development of the composite dispatching rule is carried out in the matrix development, and a new Order Rank is determined which allocates tasks first from the order with the smallest sum of allocation priority weights. Then the improved work simulation will be shown for the determined values.

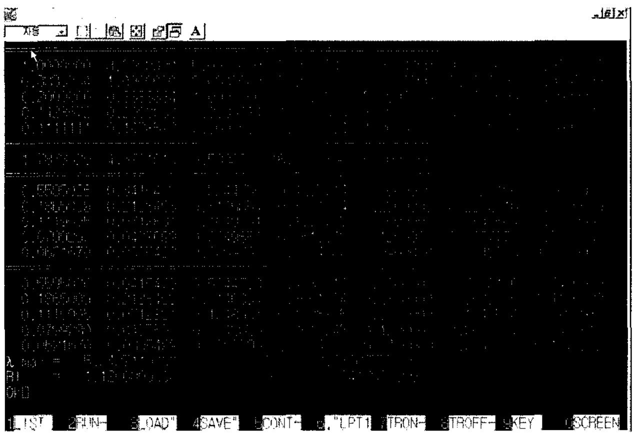
4.2 Matrix deployment of Weighted composite dispatching rule

The allocation sequence obtained with the conditions set forth in Chapter 3 is shown in table 8. The matrix operation is carried out by calculating the weights obtained from Figure4. with the order allocation sequence obtained from this table.

<Table 8> Dispatching order

Dispatching rule	Dispatching order
FCFS	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15
EDD	5-12-7-3-11-8-1-15-9-4-13-2-10-14-6
SPT	5-7-9-2-8-11-4-12-1-13-10-3-15-14-6

However, Figure4. is the preference of M Company itself analyzed from the past data, and it was adapted by applying the subjective preference of AHP (Analytic Hierarchy Process) presented by T. L. Satty. The EDD preference criteria were determined by comparing the delivery penalty and the unit delivery cost. For SPT preference, a lower value was given to the smaller average run time in production, because the smaller the run time is, the fewer are the work performance and changes as well as jig replacement works, resulting in a lower level of significance. The calculation of weights and consistency factor through AHP was performed as shown in figure 4. As can be seen from figure 4, the preferences 1, 3, 5, 7, and 9 resulted in the weight values of 0.035, 0.068, 0.134, 0.260, and 0.503, and the total of the weights is 1. We can guarantee the preference values determined through the consistency test, and apply the above weight values to the weighted EDD-SPT Relationship Matrix in this study.



<Figure 4> AHP Weights by Preference Degree

Under the characteristics of semiconductor business, the EDD-SPT Relationship Matrix arose from the inseparable relation between penalty and profits as well as between process run time and profits. When the due date of customer for semiconductor is delayed, the penalty in profits is always larger than any other product. The penalty on the room for due date directly results in profits. Therefore, we cannot but consider the influence to price and profit in connection with due date. In addition, a stable due date makes it unnecessary to supplement the unessential idle resources such as the critical order to meet the due date, the run time of rushed process, and additional deployment of work personnel. As a result, we can carry out the process without changing the sequence of STP scheduling based on the process run time. We tried to obtain a new weighted composite dispatching rule by taking into consideration the general advantages of the EDD and SPT rule as well as the profits and reduction of operation run time which are the goals of the present company. We limited the application of preference weights to the order priority of EDD and SPT. The mathematical expression of the weighted composite dispatching rule (4.1) and definitions of symbols are given below.

$$Rank[\min\{Rank(\sum w_i \cdot p_i / O^2) \times Rank(\sum w_j \cdot d_j / O^2)\}] \quad (4.1)$$

where

w_i ; weight of SPT by considering the run time

w_j ; weight of EDD by considering the penalty and price

p_i ; priority of Processing time by considering the SPT

d_j ; priority of due date by considering the EDD

O ; Total Number of order

The matrix developed according to the expression (4.1) is shown in figure 5. Each expression was worked out after considering the weights.

		3,5	10,8	3,5	1,5	7,7	7,02	0,5	7,5	6,3	2	6,5	1,8	7	7	3
	new order	7	15	6	2	14	12	1	13	8	4	9	3	10	11	5
1,5	2	0,032	0,133	0,053	0,018	0,124	0,107	0,009	0,116	0,071	0,036	0,080	0,027	0,089	0,098	0,044
4,9	9	0,280	0,600	0,240	0,080	0,560	0,480	0,040	0,516	0,320	0,160	0,360	0,120	0,400	0,440	0,200
8,1	13	0,404	0,867	0,347	0,116	0,809	0,693	0,058	0,751	0,462	0,231	0,516	0,173	0,578	0,636	0,289
1,8	3	0,093	0,200	0,080	0,027	0,187	0,160	0,013	0,173	0,107	0,053	0,120	0,040	0,133	0,147	0,067
2,4	6	0,187	0,400	0,160	0,053	0,373	0,320	0,027	0,347	0,213	0,107	0,240	0,080	0,267	0,293	0,133
7,7	12	0,373	0,800	0,320	0,107	0,747	0,640	0,053	0,693	0,427	0,213	0,480	0,160	0,533	0,587	0,267
2	4	0,124	0,267	0,107	0,036	0,249	0,213	0,018	0,231	0,142	0,071	0,160	0,053	0,178	0,196	0,089
6	10	0,311	0,667	0,267	0,089	0,622	0,533	0,044	0,578	0,356	0,178	0,400	0,133	0,444	0,489	0,222
0,3	1	0,031	0,067	0,027	0,009	0,062	0,053	0,004	0,058	0,036	0,018	0,040	0,013	0,044	0,049	0,022
6,5	11	0,342	0,733	0,293	0,098	0,684	0,587	0,049	0,636	0,391	0,196	0,440	0,147	0,489	0,538	0,244
9	14	0,436	0,933	0,373	0,124	0,871	0,747	0,062	0,809	0,498	0,249	0,560	0,187	0,622	0,684	0,311
2,1	5	0,156	0,333	0,133	0,044	0,311	0,267	0,022	0,289	0,178	0,089	0,200	0,067	0,222	0,244	0,111
4,5	8	0,249	0,533	0,213	0,071	0,498	0,427	0,036	0,462	0,284	0,142	0,320	0,107	0,356	0,391	0,178
12,6	15	0,467	1,000	0,400	0,133	0,933	0,800	0,067	0,867	0,533	0,267	0,600	0,200	0,667	0,733	0,333
3	7	0,218	0,467	0,187	0,062	0,436	0,373	0,031	0,404	0,249	0,124	0,280	0,093	0,311	0,342	0,156

<Figure 5> matrix of Weighted composite dispatching rule

From the result, we can see that the priorities of tasks were changed in the weighted composite dispatching rule. The new work order sequence can be determined by expression (4.2), and the work results are shown in table 9.

$$Rank\ [Min\{New\ Rank\ (EDD)\} \times \{New\ Rank\ (SPT)\}] \quad (4.2)$$

<Table 9> New raking

order_number	Determine	new Rnaking
TFD16-01-01	14	5
TFD256-04-02	135	13
TFD128-03-03	78	9
TFD128-03-04	6	2
TFD16-01-05	12	4
TFD256-04-06	148	14
TFD64-02-07	4	1
TFD64-02-08	130	12
TFD16-01-09	8	3
TFD64-02-10	44	8
TFD128-03-11	126	11
TFD256-04-12	15	6
TFD16-01-13	80	10
TFD128-03-14	165	15
TFD64-02-15	35	7

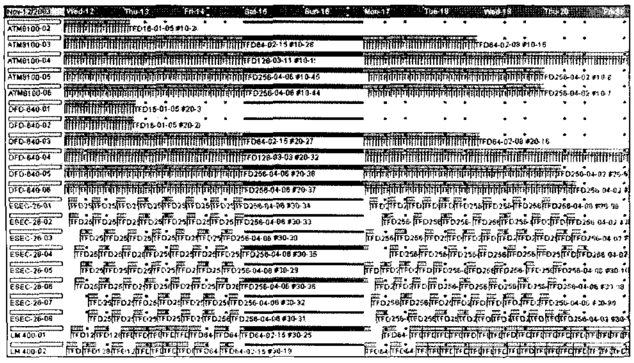
Figure 6 shows the results based on the composite EDD-SPT(Earliest Due Date-Shortest Process Time) dispatching rule.

We can see that when we considered the due date, the delayed delivery orders, average delay time, and lead time were reduced to 3, 6.61 days, 12.20 hours respectively compared tothe present FCFS. However, the total setup time for the work orders meeting the due date increased by about 32 hours to 290.85 hours, and it seems that the efficiency of process performance is lower than FCFS. This is summarized in table 10.

<Table 10> simulation statistics result of EDD-SPT

performance index	result
Total production time	12.20 days
Total setup time	290.85 hpurs
The number of tardy jobs	3 unit
Average tardiness	6.61 days

The production times for each task are shown in table 11. Among the equipment used in each process, the utilization of ATM8100 in process #10, DFD-640 in process #20, and BLUEMP7 & ASC336F in the Curing process can be expressed as table 12.



<Figure 6> Simulation result for EDD-SPT

<Table 11> Processing time of EDD-SPT

sequence	order_number	quantity	due_date	lead_time
5	TFD16-01-01	100000	2003/11/30 00:00:00	13.23
13	TFD256-04-02	20000	2003/12/15 00:00:00	2.31
9	TFD128-03-03	80000	2003/11/20 00:00:00	14.49
2	TFD128-03-04	60000	2003/12/10 00:00:00	7.90
4	TFD16-01-05	15000	2003/11/15 00:00:00	1.63
14	TFD256-04-06	250000	2003/12/30 00:00:00	43.23
1	TFD64-02-07	10000	2003/11/15 00:00:00	2.10
12	TFD64-02-08	40000	2003/11/20 00:00:00	5.82
3	TFD16-01-09	20000	2003/12/05 00:00:00	2.54
8	TFD64-02-10	70000	2003/12/15 00:00:00	14.15
11	TFD128-03-11	50000	2003/11/20 00:00:00	6.43
6	TFD256-04-12	60000	2003/11/15 00:00:00	12.69
10	TFD16-01-13	100000	2003/12/15 00:00:00	13.43
15	TFD128-03-14	200000	2003/12/20 00:00:00	23.26
7	TFD64-02-15	120000	2003/11/30 00:00:00	19.76

<Table 12> Equipment utilization of EDD-SPT

process	equipment	utilization(%)
10 process	ATM8100-01	23.21
	ATM8100-02	22.49
	ATM8100-03	97.82
	ATM8100-04	100.00
	ATM8100-05	100.00
	ATM8100-06	100.00
20 process	DFD-640-0	24.08
	DFD-640-0	22.68
	DFD-640-0	96.04
	DFD-640-0	89.08
	DFD-640-0	100.00
	DFD-640-0	100.00
Cureing process	ASC336F-01	86.72
	ASC336F-02	86.87
	BLUEMP-01	85.91
	BLUEMP-02	87.38

4.3. Compared with the simulation results

We will compare FCFS, EDD, SPT and EDD-SPT with the results of Chapter 3 and Section 4.1. First, comparison of allocation priorities is given in table 13.

<Table 13> Dispatching order for simulation

Dispatching rule	Dispatching order
FCFS	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15
EDD	5-12-7-3-11-8-1-15-9-4-13-2-10-14-6
SPT	5-7-9-2-8-11-4-12-1-13-10-3-15-14-6
EDD-SPT	5-13-9-2-4-14-1-12-3-8-11-6-10-15-7

The results of simulation by application of the prescribed 4 dispatching rules for the semiconductor process of M Company are summarized in table 15. When we compare the results of the performance indices for the 3 dispatching rules mentioned in Chapter 4 with the EDD-SPT weighted composite dispatching rule suggested in Section 4.1, we found that the present semiconductor process of M Company had many problems. When we applied the EDD-SPT weighted composite dispatching rule suggested in this study, although the total setup time increased by 32.85 hours, we could reduce the total production time by 11.27 days, and the number of works that couldn't meet the due date from 9 to 3, thus shortening the average delivery delay by 9.16 days. Furthermore, we could also improve the machine utilization for the processes by 7.27%.

<Table 14> Compared with performance Index

performance index	FCFS	EDD	SPT	EDD-SPT
Total production time	23.47 days	18.17days	12.81days	12.20 days
Total setup time	258.27hours	316.35hours	289.10hours	290.85hours
The number of tardy jobs	9 unit	6 unit	3 unit	3 unit
Average tardiness	15.77 days	8.23 days	7.77 days	6.61 days

5. Conclusion and Agenda of Future Study

The current scheduling carried out in the semiconductor assembly process follows the dispatching rule by simple

FCFS (First Come First Serve). In addition, the buffer of backlog is based on the output for one day. Accordingly, assuming that the keys to securing competitive production capability are efficient inventory management and accurate scheduling, this study applied various dispatching rules in real time to prove the effects and results of accurate scheduling through simulation. For the semiconductor process of M Company, we compared the results of performance indices for the present FCFS dispatching rule, EDD dispatching rule, and SPT dispatching rule with those of the EDD-SPT weighted composite dispatching rule suggested in this study. As a result, we found that the present semiconductor process of M Company had many problems. When we applied the EDD-SPT weighted composite dispatching rule, thetotal setup time increased by 32.85 hours, but we could reduce the total production time by 11.27 days, and the number of works that couldn't meet the due date from 9 to 3, thus shortening the average delivery delay by 9.16 days. Furthermore, we could also improve the machine utilization for the processes by 7.27%. However, as pointed out above, the EDD-SPT weighted composite dispatching rule is not the best for all performance indices. Therefore, it is important to determine the optimal dispatching rule based on the performance indices that decision makers manage in high priority after first deciding on a dispatching rule for maintaining the optimum status in eachprocess. Further researches are required in this regard.

Reference

[1] Baek, D.H., Yoon, W.C and Park, S.C.,(1998), A spatial rule adaptation procedure for reliable production control in a wafer fabrication system, *International Journal of Production Research 36(6), 1475-1491*

[2] Egbelu, D. R and Beale, M.(1984), Characterization of automatic-guided vehicle dispatching rules, *International Journal of Production Research 22, 359-374*

[3] Hung, Y. F. and Chen, I. P.(1998), A simulation study of dispatch rules for reducing flow times in semiconductor wafer fabrication, *Production Planning & Control, 9(7), 714-722*

[4] Lin, J, T., Wang, F. and Yen, P.(2001), Simulation analysis of dispatching rules for an automated interbay material handling system in wafer fab, *International Journal of Production Research 39(6), 1221-1238*

[5] Lu, S. C. H. and Kumar, P. R,(1991), Distributed scheduling based on due dates and buffer priorities, *IEEE Transactions on Automatic Controls, 36, 1406-1416*

[6] Nakata, T., Matsui, K., Miyake, Y. and Nishioka, K.(1999), Dynamic bottleneck control in wide variety production factory, *IEEE Transactions on Semiconductor Manufacturing, 12(3), 273-280*

[7] Pinedo(2001), *Scheduling 2/E: Theory, Algorithma, and Systems*, Prentice Hall

[8] Wein, L. M.(1998), scheduling semiconductor wafer fabrication" *IEEE Transactions on Semiconductor Manufacturing, 1(3), 115-130*