

Development of Scheduling Coordination System for Assembly Plants of Shipbuilding

207-43

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Abstract

The production process of shipbuilding is very complex in nature. To build an efficient shipbuilding scheduling system so as to reduce the inherent computational complexity, DAS (Daewoo Shipbuilding Scheduling System) has adopted a two-layered hierarchical architecture. In the hierarchical architecture, individual scheduling systems composed of a higher-level dock scheduler, DAS-ERECT and lower-level assembly plant schedulers, DAS-PBS, DAS-3DS, DAS-NPS, and DAS-A7 try to search the best schedules under their own constraints.

However, as an individual scheduler does not communicate with others during scheduling an assembly plant, another similar individual scheduler can not resolve trivial problems caused by an individual scheduler. That is, even if an individual scheduler optimizes an assembly plant, it guarantees only the local optimum.

In this paper, we suggest 'Knowledge-Based Load Balancing and Load Transfer Algorithm' to resolve the problems among the multiple assembly plant schedulers. The one is a 3-dimensional look ahead load balancing before scheduling assembly plants using the domain knowledge, while the other is a 3-dimensional post load transfer after scheduling assembly plants.

A prototype scheduling coordination system, DAS-ASICS (Assembly Schedule Integrated Control System), is implemented as a subsystem of DAS using the expert system development tool UNIK on SUN SPARC station. A series of experiments using the real-world data are also carried out to guide the equilibrium of load among assembly plant schedulers.

1.

가? (dock)

' (block)'

400 ~ 500

(crane)

(erection)

< 1>

' DAS
(Hierarchical Architecture)
, DAS-ERECT

, DAS-PBS, DAS-

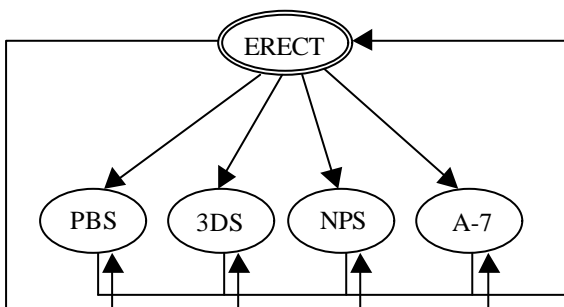
3DS, DAS-NPS, DAS-A7

가

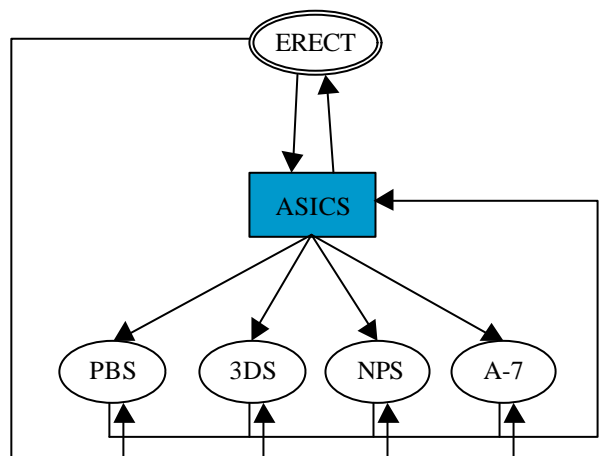
가

< 2>
(System)

(DAS-ASICS, Assembly Schedule Integrated Control



< 1> DAS



< 2> DAS

2.

NP-hard 가 ,
 . , (Distributed
 Operating System) CPU
 [1][2]. ,
 (computational complexity) , (learning) 가 ,
 (dynamic rescheduling or reactive scheduling) 가 ,
 (AI-Based Approach) , DAS [3].
 (Agent-Based
 Supply Chain Management) ,
 [4][5].

3.

,
 .
 . 가
 .
 .

3.1.

3.1.1.

(1)

, , 1 , 2 , 3
 가 . 2
 , ,
 , 가
 , 가
 , 가

(DEFRAME Pref1099-227

(IS-A PrefBlk)

(Partof Pref1099)

(Shop1 3DS)

(Shop2 A-7)

(Shop3)

(DivShop N+3)

(Dur1 (G 8) (H 7) (R 7) (S 4))

(Dur2 (G 10) (H 7) (R 7) (S 5))

(Dur3 (G) (H) (R) (S))

(DivDur (G 8) (H 4) (R 7) (S 4))

< 3>

(2)

가

,

PBS 3DS

, PBS

3DS

. , PBS

NPS

single hull

가

.

(DEFRAME PriorPBS23DS

(IS-A Prior)

(From PBS)

(To 3DS)

(Prior1 (Unit DecUnit) (ErrorR 0.1))

(Prior2 (Proj Container Ro/Ro B/C COTorVLCC))

(Prior3 (Blk 1 2 6 5 7 4))

(DEFRAME PriorPBS2NPS

(IS-A Prior)

(From PBS)

(To NPS)

(Inclusion (Blk (B/C 1 5 6) (Container 1) (COTorVLCC 1 4)) (Weight 220))

< 4>

(3)

(MH = JL *

)가 . , , .

3.1.2.

(1)

가 .

(2)

(FT)

(ST)

가 .

(3) Time slot

, , 가 .

3.2.

(1)

, line ,

(DEFRAME 3DS-GMH

(IS-A SubShopMH)

(SubShop 3DS-G)

(1996/06 (capa 43637.776000) (used 49828.210865)

(1099-227-G7 220.000000) (1102-267-G9 342.571429) (1103-221-G7 128.000000))

(1996-24 (capa 11163.152000) (used 12452.356822)

(1099-227-G7 47.142857) (1102-267-G9 93.428571) (1103-221-G7 100.571429)))

< 5 >

(2)

3.3.

, . , , .

3 ,

iteration

가

(delayed block)

step

(1)

Step 1:

1

Step 2:

가

go to step 3.

Step 3:

가

over-capacity shop

under-capacity shop

Step 4:

over-capacity

under-capacity

movable block list

Step 5:

movable block list

Step 6:

(2)

Step 1:

Step 2:

movable block list

go to step 3.

Step 3:

movable block list

Step 4:

over-capacity shop

under-capacity shop

Step 5:

under-capacity shop

Step 6:

4. Prototype

DAS-ASICS(Assembly Schedule Integrated Control System)

DAS-ASICS

1994

5

1996

8

가

(DAS II)

가

UNIK

SUN SPARC station

DAS-ASICS

96

6

96

11

6

DAS-ASICS

< 1 >

가

29.61%, 18.24%, 15.77%

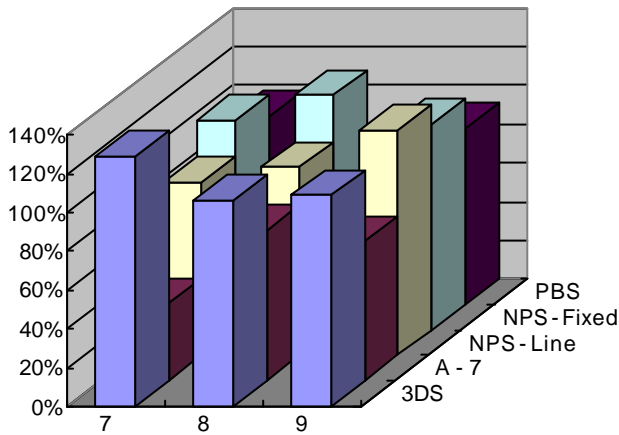
6.93%, 11.44%, 10.23%

	7	8	9
3DS	129%	106%	109%
A-7	40%	78%	72%
NPS-Line	89%	97%	116%
NPS-Fixed	108%	121%	106%
PBS	97%	71%	91%
	93%	95%	99%
	29.61%	18.24%	15.77%

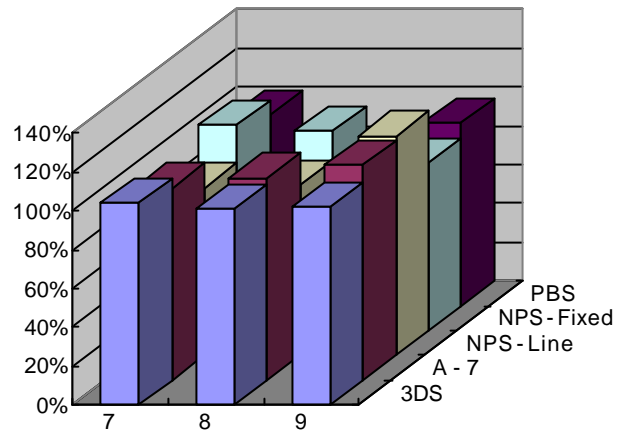
< 1>

	7	8	9
	104%	101%	102%
	99%	104%	111%
	86%	88%	113%
	106%	103%	86%
	98%	74%	94%
	99%	94%	101%
	6.93%	11.44%	10.23%

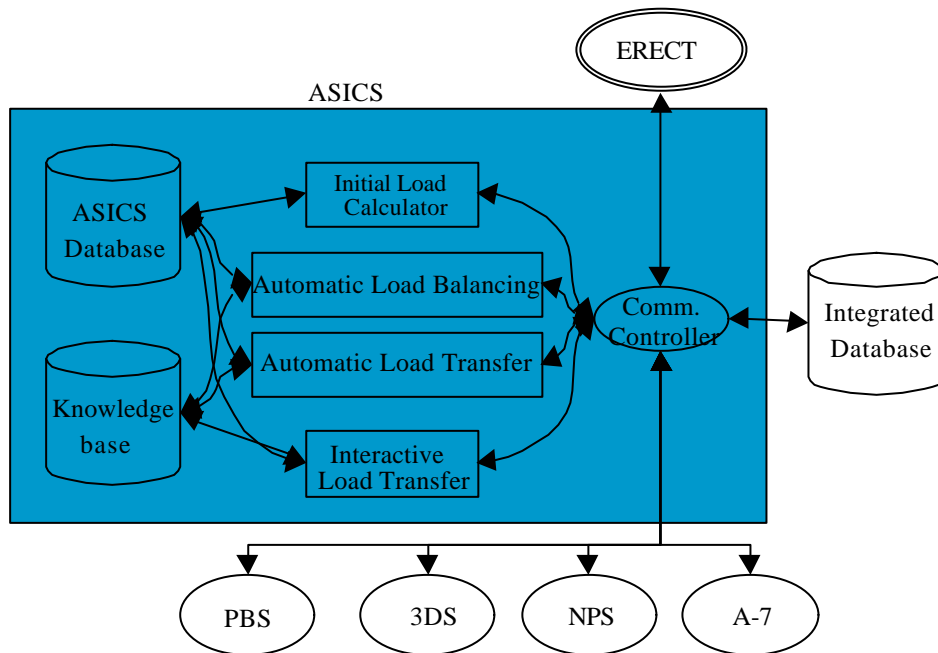
< 2>



< 6>



< 7>



< 8> DAS-ASICS

S H O P 편 입원조원 및 예정

대상 호선: 4821 5789 5787 5106 5165 5164 5163 5182 4417 4416 4895 4895 4904 대상 기간: 1997/11/11 ~ 1998/03/31

동원조원 구분: *입원특수조원 *입원일반조원 *대응수업별별안/조원도조회

SHOP	구분	1996/11	1996/12	1997/01	1997/02	1997/03	1997/04	1997/05	1997/06	1997/07	1997/08	1997/09	1997/10	1997/11
F B S	총량	33217	142346	104414	154437	199257	201617	193327	180737	167895	190461	175218	208719	
	조원도	29	85	116	154	116	128	121	115	114	118	121	132	
S G O S	총량	26185	47595	65416	71391	83843	89413	88087	79227	79898	78371	55882	98867	
	조원도	59	32	107	111	119	111	105	168	111	105	102	122	
신규소 (여간)	총량	17289	31778	44457	26470	30354	45983	44347	36826	38848	48374	42785	52478	
	조원도	9	29	127	156	97	96	185	98	102	106	113	128	
신규소 (고장)	총량	56322	30652	23176	26322	48665	37625	49386	47949	46862	47184	44117	36237	
	조원도	26	47	63	186	122	128	129	119	127	125	136	107	
A-기	총량	6999	56262	47628	33832	44172	31758	28476	17369	20721	18046	20299	16798	
	조원도	195	43	183	136	159	116	185	96	95	101	119	72	
한계	총량	182922	271842	257612	333861	424368	427615	387546	288779	249618	272066	226462	494828	
	조원도	30	79	118	154	118	117	138	168	111	115	134	119	

호선 목록 호선예정일 대입예정일 입원 시수 유형 부서구분 담당 작업 S H O P :

1110 111 1996/12/17 1997/01/22 1996/12/17 1997/01/22 1488 2182 889 3-A 실적

1110 240 작업일 : 1997/01

1110 251 호선 : 1115 일 : 252 일 : 1489 작업 SHOP : 31F 조정일 :

1110 281 기간 : 1997/06/24 ~ 1997/06/24 조원 S H O P : S H O P 구분 :

1110 235 번호 SHOP : 305

1110 883 입원예정일 : 1997/02/14 소요시수 : 1064 세수번호 :

1110 895 대조장기 : 발송장기 : 발송장기 : 소조장기 :

1110 925

1110 924

1110 935

1110 804

1110 181

< 9 >

5.

3

DAS-

ASICS(Assembly Schedule Integrated Control System)

DAS-ASICS

가

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