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APPENDICES

APPENDIX A: Data before Improvement

Part name: Chair's Front leg

Run No.	Metallic Projection	Cavities	Defective Surface
1	1	1	2
2	0	1	3
3	1	3	3
4	2	1	4
5	1	5	4
6	0	3	3
7	0	3	2
8	1	3	3
9	1	2	4
10	2	3	2
11	1	3	3
12	1	1	3
13	2	3	2
14	2	2	3
15	2	4	4
16	0	3	3
17	1	5	4
18	1	4	3
19	2	4	4
20	1	1	3
21	2	2	2
22	1	3	3
23	0	3	4
24	1	2	2
25	2	0	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	4	0	3
27	3	1	2
28	4	0	3
29	1	1	3
30	3	2	3
31	2	2	3
32	1	1	2
33	5	0	3
34	3	5	3
35	2	1	2
36	2	0	3
37	1	1	3
38	2	0	3
39	4	0	2
40	3	1	3
41	1	1	2
42	2	2	3
43	2	0	3
44	4	1	3
45	3	5	4
46	1	1	3
47	1	1	3
48	2	0	3
49	2	1	3
50	1	1	3

Run No.	Metallic Projection	Cavities	Defective Surface
51	2	0	3
52	4	0	2
53	3	1	3
54	5	0	3
55	2	0	3
56	2	1	3
57	1	0	4
58	3	6	3
59	2	4	4
60	1	1	3
61	3	1	4
62	4	0	2
63	2	0	4
64	1	0	3
65	1	1	4
66	3	5	2
67	5	0	3
68	3	1	4
69	2	1	3
70	1	1	4
71	2	1	3
72	4	0	4
73	4	2	3
74	2	0	3
Total	149	119	226

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Chair's Back leg

Run No.	Metallic Projection	Cavities	Defective Surface
1	1	2	2
2	1	1	4
3	2	3	3
4	1	0	2
5	0	0	2
6	3	0	4
7	2	0	3
8	1	0	3
9	2	2	4
10	1	0	3
11	3	0	4
12	1	0	4
13	0	3	3
14	0	0	2
15	1	0	3
16	2	3	2
17	3	0	3
18	3	0	3
19	1	0	4
20	1	0	4
21	2	1	3
22	1	1	3
23	2	2	4
24	2	0	3
25	2	2	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	1	1	3
27	2	4	4
28	4	1	3
29	3	2	2
30	2	0	3
31	4	0	4
32	3	4	3
33	1	0	4
34	1	1	3
35	5	1	2
36	1	0	2
37	1	1	4
38	1	1	3
39	1	1	3
40	3	4	2
41	3	2	3
42	2	0	C
43	2	0	C
44	5	1	2
45	1	1	3
46	1	1	4
47	4	1	3
48	1	0	4
49	5	1	3
50	2	2	3

Run No.	Metallic Projection	Cavities	Defective Surface
51	5	0	2
52	2	0	4
53	1	1	4
54	2	2	3
55	1	1	3
56	2	4	2
57	1	0	4
58	3	4	3
59	2	2	3
60	2	0	3
61	4	0	2
62	2	2	4
63	4	1	3
64	3	2	3
65	1	0	2
66	2	4	4
67	3	4	3
68	1	0	4
69	1	1	2
70	4	0	2
71	4	3	4
72	2	0	2
73	2	2	3
74	5	0	4
Total	156	83	228

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Seat

Run No.	Metallic Projection	Cavities	Defective Surface
1	4	2	2
2	3	2	4
3	1	1	3
4	2	2	3
5	2	3	3
6	3	2	3
7	1	1	4
8	2	1	3
9	1	2	3
10	3	1	3
11	1	2	3
12	2	5	4
13	4	1	4
14	3	1	3
15	4	3	3
16	2	2	3
17	1	2	4
18	1	1	3
19	4	2	3
20	1	1	4
21	2	2	3
22	4	0	2
23	3	3	3
24	1	1	4
25	1	1	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	2	2	4
27	1	1	3
28	2	2	3
29	3	2	4
30	1	1	3
31	4	2	3
32	2	0	2
33	7	2	3
34	1	3	3
35	3	1	4
36	1	5	4
37	3	2	4
Total	86	67	107

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Backrest

Run No.	Metallic Projection	Cavities	Defective Surface
1	6	2	4
2	5	1	3
3	7	3	3
4	8	1	3
5	7	3	4
6	4	4	4
7	7	2	3
8	8	3	3
9	8	2	3
10	3	2	4
11	7	3	3
12	7	1	4
13	6	2	3
14	3	3	4
15	5	4	4
16	3	3	3
17	2	1	3
18	5	2	3
19	3	3	2
20	4	1	4
21	3	0	3
22	7	2	4
23	2	3	3
24	4	2	3
25	6	2	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	2	1	3
27	2	1	4
28	4	2	3
29	7	1	3
30	3	0	4
31	6	3	3
32	6	1	3
33	5	2	2
34	8	3	4
35	5	1	3
36	7	3	4
37	3	2	4
Total	188	75	123

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Left Arm

Run No.	Metallic Projection	Cavities	Defective Surface
1	1	2	2
2	4	2	4
3	1	3	3
4	2	1	3
5	1	3	2
6	3	4	4
7	2	1	3
8	1	2	3
9	2	1	2
10	1	2	2
11	5	3	3
12	1	4	3
13	2	2	4
14	3	0	4
15	1	2	3
16	2	3	3
17	1	1	3
18	3	3	4
19	1	3	3
20	1	3	2
21	3	2	4
22	2	4	3
23	1	2	4
24	2	1	3
25	1	2	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	3	4	2
27	3	2	2
28	2	3	3
29	1	1	3
30	2	2	2
31	1	1	3
32	3	4	3
33	4	2	3
34	3	2	2
35	3	3	3
36	1	2	3
37	2	1	2
Total	75	83	108

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Right Arm

Run No.	Metallic Projection	Cavities	Defective Surface
1	1	0	4
2	1	1	3
3	1	2	3
4	1	1	3
5	2	2	2
6	1	2	4
7	3	3	3
8	1	1	3
9	1	3	4
10	3	2	3
11	2	4	2
12	1	3	3
13	4	4	3
14	3	2	4
15	1	2	3
16	3	2	2
17	2	1	2
18	2	3	3
19	1	1	3
20	4	4	4
21	2	3	4
22	2	1	3
23	3	2	3
24	2	1	3
25	3	4	2

Run No.	Metallic Projection	Cavities	Defective Surface
26	4	3	4
27	1	2	3
28	2	1	3
29	4	2	3
30	2	3	4
31	4	1	4
32	1	2	4
33	2	1	3
34	3	4	3
35	2	2	3
36	4	3	3
37	1	4	2
Total	80	82	115

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Table's Leg

Run No.	Metallic Projection	Cavities	Defective Surface
1	0	1	4
2	2	3	3
3	4	1	2
4	1	0	3
5	3	1	2
6	1	2	4
7	2	2	3
8	1	3	2
9	2	1	3
10	3	4	2
11	2	3	3
12	1	4	4
13	1	1	3
14	2	3	3
15	3	1	2
16	1	1	3
17	2	2	3
18	3	2	2
19	2	2	3
20	1	1	2
21	2	3	3
22	2	1	3
23	1	1	4
24	2	3	3
25	1	1	3

Run No.	Metallic Projection	Cavities	Defective Surface
26	3	3	4
27	2	4	3
28	1	2	3
29	3	1	2
30	4	1	3
31	1	2	4
32	2	2	3
33	2	3	2
34	1	3	3
35	2	1	3
36	1	2	4
Total	67	71	26

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Desktop

Run No.	Metallic Projection	Cavities	Defective Surface
1	3	2	3
2	2	4	3
3	2	3	2
4	3	2	4
5	1	2	3
6	2	3	3
7	3	1	3
8	2	2	2
9	1	3	3
Total	19	22	26

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

APPENDIX B: 2⁶ Experiment Record

Part Name: Chair's Front Leg

Standard No.	Run No.	A	B	C	D	E	F = ABCDE	Metallic projection					Cavities					Defective Surface				
								1	2	3	4	Sum	1	2	3	4	Sum	1	2	3	4	Sum
1	12	-	-	-	-	-	-	0.00	1.00	0.00	0.00	1.00	1.73	1.41	1.41	1.00	5.56	2	2	2	2	8
2	16	+	-	-	-	-	+	0.00	1.41	1.00	0.00	2.41	0.00	1.41	2.24	1.73	5.38	1	3	2	2	8
3	7	-	+	-	-	-	+	0.00	0.00	1.00	0.00	1.00	1.73	1.41	1.41	2.00	6.56	1	3	1	3	8
4	5	+	+	-	-	-	-	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.73	2.73	3	3	2	3	11
5	8	-	-	+	-	-	+	0.00	0.00	1.00	1.00	2.00	0.00	0.00	1.41	1.41	2.83	2	2	2	3	9
6	13	+	-	+	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	4	4	4	16
7	11	-	+	+	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.41	2.41	4	4	4	4	16
8	3	+	+	+	-	-	+	0.00	1.00	0.00	0.00	1.00	1.41	1.00	1.41	1.41	5.24	4	4	4	4	16
9	4	-	-	-	+	-	+	0.00	1.00	0.00	1.00	2.00	1.41	1.00	1.41	1.41	5.24	2	2	1	1	6
10	10	+	-	-	+	-	-	0.00	0.00	0.00	1.00	1.00	1.41	1.00	1.41	1.41	5.24	1	1	1	2	5
11	1	-	+	-	+	-	-	0.00	1.00	0.00	0.00	1.00	1.73	2.00	2.00	1.00	6.73	3	2	2	2	9
12	9	+	+	-	+	-	+	0.00	0.00	0.00	0.00	0.00	1.41	1.00	0.00	1.41	3.83	3	3	2	2	10
13	15	-	-	+	+	-	-	0.00	1.73	0.00	0.00	1.73	0.00	0.00	1.00	1.00	2.00	3	4	3	3	13
14	6	+	-	+	+	-	+	0.00	1.00	0.00	1.00	2.00	1.73	2.00	1.41	1.73	6.88	3	3	3	3	12
15	14	-	+	+	+	-	+	0.00	0.00	1.00	1.41	2.41	0.00	1.00	1.41	1.00	3.41	3	3	3	3	12
16	2	+	+	+	+	-	-	0.00	0.00	0.00	0.00	0.00	2.00	0.00	1.00	1.41	4.41	4	3	4	4	15
17	17	-	-	-	-	+	+	1.41	1.00	1.00	0.00	3.41	2.00	2.24	2.00	1.41	7.65	4	3	4	4	15
18	25	+	-	-	-	+	-	1.41	1.00	1.00	0.00	3.41	1.00	1.41	0.00	1.41	3.83	4	4	4	4	16
19	21	-	+	-	-	+	-	1.41	0.00	0.00	0.00	1.41	1.41	1.41	1.00	1.41	5.24	4	3	3	4	14
20	32	+	+	-	-	+	+	1.00	0.00	1.41	0.00	2.41	1.73	2.00	1.00	1.73	6.46	2	3	3	3	11
21	19	-	-	+	-	+	-	0.00	1.00	1.41	0.00	2.41	1.00	1.73	2.00	1.41	6.15	4	4	4	3	15
22	22	+	-	+	-	+	+	0.00	0.00	1.00	1.00	3.00	1.41	1.41	2.24	2.65	7.71	3	3	4	4	14
23	24	-	+	+	-	+	+	0.00	0.00	0.00	0.00	0.00	0.00	1.73	1.41	0.00	3.15	4	3	4	3	14
24	18	+	+	+	-	+	-	1.41	1.00	1.00	1.41	4.83	2.45	2.83	2.00	1.73	9.01	4	4	4	4	16
25	28	-	-	-	+	+	-	1.00	1.41	0.00	1.00	3.41	1.41	1.73	1.41	1.41	5.97	3	3	3	4	13
26	20	+	-	-	+	+	+	1.00	0.00	1.00	1.00	3.00	1.00	2.00	1.41	1.41	5.83	3	3	3	3	12
27	26	-	+	-	+	+	+	1.00	0.00	1.00	1.00	3.00	1.41	1.73	1.73	1.41	6.29	3	4	4	4	15
28	23	+	+	-	+	+	-	1.41	1.41	0.00	1.41	4.24	1.41	1.73	2.00	1.73	6.88	3	4	3	3	13
29	27	-	-	+	+	+	+	1.00	0.00	1.00	1.41	3.41	0.00	0.00	1.41	1.41	2.83	4	4	4	2	14
30	29	+	-	+	+	+	-	1.41	1.00	0.00	1.00	3.41	1.73	1.73	2.00	0.00	5.46	4	4	3	3	14
31	31	-	+	+	+	+	-	1.00	1.00	1.41	1.00	4.41	1.73	2.24	1.00	1.41	6.38	3	3	3	2	11
32	30	+	+	+	+	+	+	1.00	1.00	0.00	1.41	3.41	2.00	1.41	1.41	2.00	6.83	2	3	3	2	10

Remark: A = Pouring Height, B = No. of Gates, C = Snow powder quantity, D = Solidification time, E = Aluminum Combination, and F = Gate Size. The numbers under categories of Metallic projection and Cavities are transformed numbers of defects in each sample. For numbers under categories of Defective Surface refers to grade of surface's leg

Part Name: Chair's Back Leg

Standard No.	Run No.	A	B	C	D	E	F = ABCDE	Metallic projection					Cavities					Defective Surface					
								1	2	3	4	Sum	1	2	3	4	Sum	1	2	3	4	Sum	
1	12	-	-	-	-	-	-	0.00	0.00	1.00	0.00	1.00	0.00	0.00	1.41	2.00	0.00	3.41	2	2	2	2	8
2	16	+	-	-	-	-	+	1.41	1.00	0.00	0.00	2.41	0.00	0.00	1.00	1.00	2.00	1	3	2	2	8	
3	7	-	+	-	-	-	+	0.00	0.00	1.00	0.00	1.00	1.00	1.41	0.00	1.73	4.15	1	3	1	3	8	
4	5	+	+	-	-	-	-	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.73	2.73	2	3	2	3	10	
5	8	-	-	+	-	-	+	0.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	4.00	2	2	3	2	9	
6	13	+	-	+	-	-	-	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	4	4	4	4	16	
7	11	-	+	+	-	-	-	0.00	1.41	1.00	0.00	2.41	1.00	1.41	0.00	0.00	2.41	4	4	4	4	16	
8	3	+	+	+	-	-	+	1.00	1.41	1.00	0.00	3.41	2.45	1.00	2.00	1.00	6.45	4	4	4	4	16	
9	4	-	-	-	+	-	+	0.00	0.00	1.00	0.00	1.00	1.00	1.41	1.00	1.41	4.83	1	1	1	1	4	
10	10	+	-	-	+	-	-	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	4.00	1	1	1	2	5	
11	1	-	+	-	+	-	-	1.00	0.00	1.00	0.00	2.00	1.41	1.00	0.00	2.00	4.41	3	2	2	3	10	
12	9	+	+	-	+	-	+	1.00	1.00	0.00	0.00	2.00	0.00	0.00	0.00	1.41	1.41	2	3	2	2	9	
13	15	-	-	+	+	-	-	0.00	0.00	0.00	0.00	0.00	1.41	1.00	1.73	1.00	5.15	3	4	3	3	13	
14	6	+	-	+	+	-	+	1.00	0.00	1.00	0.00	2.00	1.00	1.00	1.73	1.73	5.46	3	3	3	3	12	
15	14	-	+	+	+	-	+	0.00	0.00	1.00	1.41	2.41	1.41	1.00	1.41	1.73	5.56	2	3	3	3	11	
16	2	+	+	+	+	-	-	0.00	0.00	0.00	0.00	0.00	0.00	1.41	1.41	0.00	2.83	4	3	4	4	15	
17	17	-	-	-	-	+	+	1.00	0.00	0.00	1.00	2.00	1.41	0.00	1.41	1.00	3.83	4	3	4	3	14	
18	25	+	-	-	-	+	-	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.41	2.24	4.65	4	4	4	4	16	
19	21	-	+	-	-	+	-	1.00	0.00	1.00	0.00	2.00	1.41	1.73	1.41	2.24	6.80	4	3	3	3	13	
20	32	+	+	-	-	+	+	1.41	0.00	1.41	1.00	3.83	1.41	2.83	1.73	2.83	8.80	3	3	3	3	12	
21	19	-	-	+	-	+	-	0.00	1.00	0.00	1.41	2.41	1.41	1.41	1.73	1.41	5.97	4	3	4	3	14	
22	22	+	-	+	-	+	+	1.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	1.41	2.41	4	3	3	3	13	
23	24	-	+	+	-	+	+	0.00	0.00	1.00	1.00	2.00	1.41	0.00	1.41	1.73	4.56	4	3	3	3	13	
24	18	+	+	+	-	+	-	1.41	1.41	1.00	1.00	4.83	2.24	2.00	2.24	2.00	8.47	4	4	4	4	16	
25	28	-	-	-	+	+	-	0.00	1.00	1.41	0.00	2.41	1.41	1.00	1.41	2.00	5.83	3	4	3	4	14	
26	20	+	-	-	+	+	+	0.00	1.00	0.00	1.00	2.00	1.41	1.00	0.00	1.73	4.15	3	3	3	3	12	
27	26	-	+	-	+	+	+	1.41	0.00	0.00	1.00	2.41	0.00	2.24	1.41	1.00	4.65	3	3	3	3	12	
28	23	+	+	-	+	+	-	1.00	1.41	1.41	0.00	3.83	2.24	2.00	2.83	1.73	8.80	3	4	4	3	14	
29	27	-	-	+	+	+	+	1.00	0.00	1.00	1.00	3.00	0.00	1.73	1.00	1.41	4.15	4	4	3	4	15	
30	29	+	-	+	+	+	-	1.41	0.00	1.00	0.00	2.41	2.24	1.41	2.83	1.00	7.48	4	4	4	4	16	
31	31	-	+	+	+	+	-	1.41	0.00	1.41	0.00	2.83	1.73	1.41	2.00	1.41	6.56	3	3	3	2	11	
32	30	+	+	+	+	+	+	0.00	1.00	0.00	1.00	2.00	1.41	1.41	1.73	1.00	5.56	2	3	3	2	10	

Remark: A = Pouring Height, B = No. of Gates, C = Snow powder quantity, D = Solidification time, E = Aluminum Combination, and F = Gate Size. The numbers under categories of Metallic projection and Cavities are transformed numbers of defects in each sample. For numbers under categories of Defective Surface refers to grade of surface's leg

APPENDIX C: Follow up run**Part name: Chair's Front leg**

Run No.	Metallic Projection	Cavities	Defective Surface
1	1	1	2
2	0	1	1
3	0	0	2
4	1	1	1
5	2	2	3
6	1	3	1
7	1	1	2
8	0	1	2
9	0	2	1
10	3	1	2
11	1	0	3
12	0	2	1
13	0	1	2
14	1	1	1
15	2	0	2
16	1	1	2
17	1	1	1
18	1	2	3
19	0	0	1
20	1	1	2
21	3	1	2
22	1	0	2
23	1	1	1
24	0	0	1
25	1	0	1

Run No.	Metallic Projection	Cavities	Defective Surface
26	0	1	2
27	0	1	2
28	1	2	2
29	2	0	1
30	0	1	1
31	2	0	2
32	1	2	1
33	0	2	2
34	1	1	2
35	0	2	1
36	1	2	1
37	0	2	2
38	1	2	2
39	2	1	1
40	0	0	1
41	0	0	1
42	1	1	2
43	1	2	2
44	0	1	1
Total	36	47	71

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Part name: Chair's Back leg

Run No.	Metallic Projection	Cavities	Defective Surface
1	2	1	3
2	1	0	2
3	0	1	1
4	0	1	2
5	1	2	2
6	1	1	1
7	0	0	2
8	0	1	1
9	1	0	2
10	0	1	3
11	0	3	2
12	1	0	1
13	1	1	2
14	1	1	1
15	0	1	2
16	0	2	1
17	2	1	3
18	1	1	1
19	1	0	1
20	0	1	2
21	0	1	1
22	1	1	3
23	3	2	2
24	0	0	2
25	2	1	2

Run No.	Metallic Projection	Cavities	Defective Surface
26	2	0	2
27	1	2	1
28	0	0	2
29	1	0	2
30	0	1	1
31	1	1	1
32	2	0	2
33	0	1	1
34	0	2	1
35	1	1	1
36	0	2	1
37	0	2	2
38	1	2	1
39	2	1	1
40	0	0	2
41	2	1	1
42	1	2	1
43	1	0	2
44	1	1	1
Total	35	43	71

Remark: Number under categories of Metallic Projection and Cavities refer to number of defects in each leg. For Defective Surface number refers to grade of surface's leg

Biography

Thiti Rajsirisongsri was born in Bangkok, 1981. He graduated from Thammasat University (TH) and University of Nottingham (UK) in 2004 in Bachelor of Industrial Engineering and Bachelor of Engineering in Manufacturing Engineering and Management. He continues his study in Engineering Business Management for Master Degree at Regional Centre for Manufacturing Systems Engineering, Chulalongkorn University (TH) and University of Warwick (UK).

