



## Modelling a Novel Multi-Objective Open-Shop Scheduling Problem and Solving by a Scatter Search Method

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### Keywords

Open shop scheduling problems,  
Tardiness and earliness time,  
Makespan, Setup cost, NSGA-II,  
Multi-objective scatter search

### ABSTRACT

*This paper proposes a novel, multi-objective integer programming model for an open-shop scheduling problem (OSSP). Three objectives are to minimize the makespan, total job tardiness and earliness, and total jobs setup cost. Due the complexity to solve such a hard problem, we develop a meta-heuristic algorithm based on multi-objective scatter search (MOSS), and a number of test problems are solved by this proposed algorithm. Finally, to prove its efficiency, the related results are compared with the results obtained by the well-known multi-objective evolutionary algorithm, called NSGA-II. The results confirm the efficiency and the effectiveness of our proposed MOSS to provide good solutions, especially for medium and large-sized problems.*

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NP-hard

NSGA-II

NSGA-II

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Parent 1	<b>2</b>	<b>4</b>	<b>1</b>	<b>5</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>9</b>	<b>8</b>
Parent 2	4	6	9	5	3	1	2	7	8

Child 1	<b>2</b>	<b>4</b>	<b>1</b>	<b>6</b>	5	7	<b>3</b>	<b>9</b>	<b>8</b>
Child 2	4	6	9	<b>1</b>	<b>5</b>	<b>3</b>	2	7	8

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2	5	3	6	4	1
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4	2	6	3	1	5
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$n \times m$

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4	2	6	3	1	5
1	2	6	3	4	5
5	2	6	3	4	1
2	5	6	3	4	1
2	5	3	6	4	1

(S<sub>1</sub>,S<sub>2</sub>,S<sub>3</sub>)

Refset1 : S<sub>1</sub>  
 |b<sub>1</sub>-1|  
 Refset2 : S<sub>2</sub>  
 |b<sub>2</sub>-1| N  
 Refset1 : S<sub>3</sub> [ ]  
 Refset2  
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 Refset2  
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Original trial solution 1 : 1 4 7 | 2 3 5 | 9 8 6  
 Original trial solution 2 : 3 9 5 | 2 4 6 | 1 7 8

( ) Refset2 ( ) Refset1

.|Refset|=b<=b<sub>1</sub>+b<sub>2</sub> b<sub>2</sub> b<sub>1</sub>  
 Refset1  
 b<sub>1</sub>

New trial solution 1 : 9 8 6 | 1 4 7 | 2 3 5  
 New trial solution 2 : 1 7 8 | 3 9 5 | 2 4 6

Refset1  
b<sub>1</sub>

b<sub>2</sub> Refset2

New trial solution 1 : 9 8 1 7 3 5  
 New trial solution 2 : 1 7 8 9 4 6

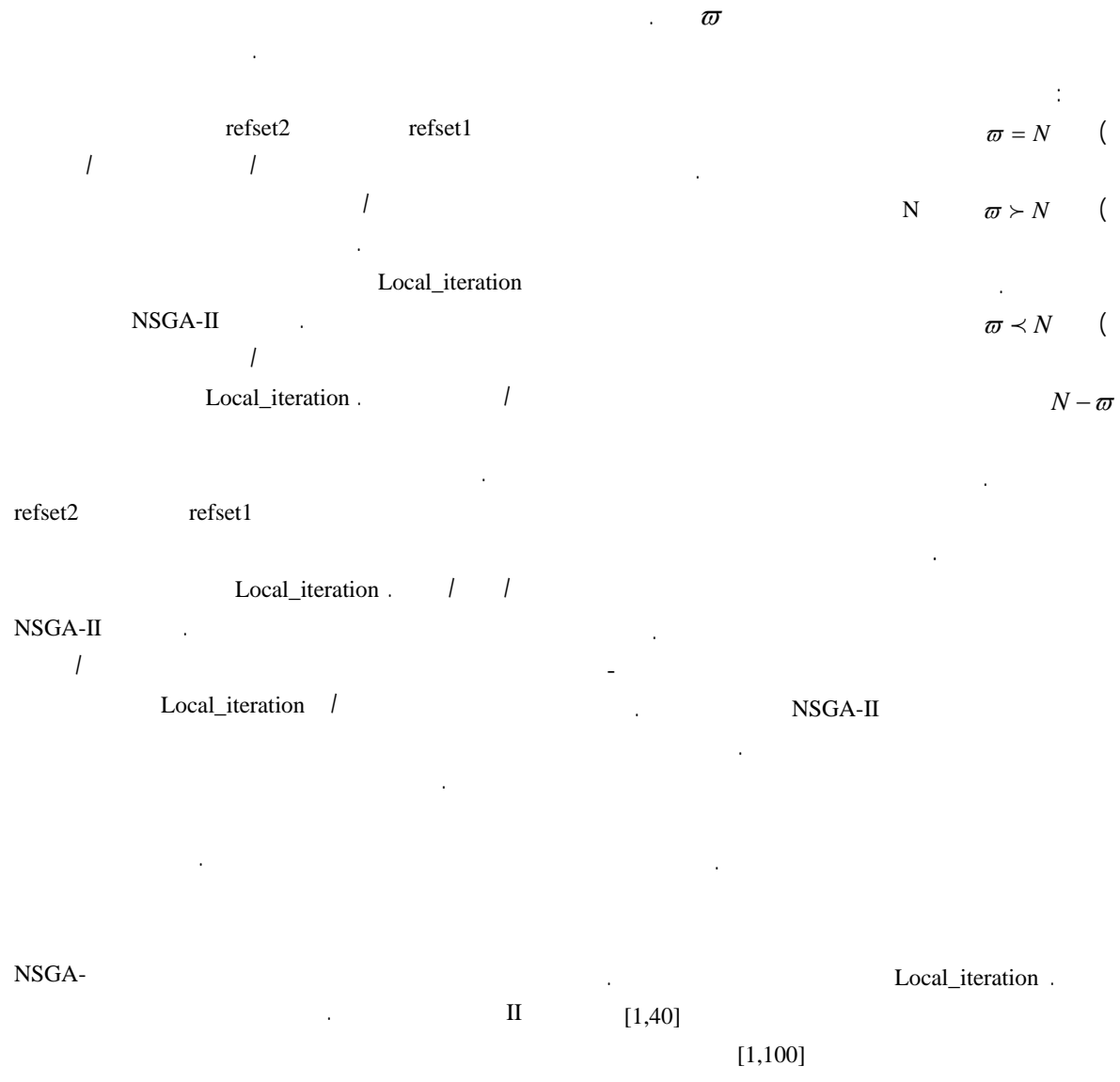
Refset2

Refset1  
Refset1



$[0.2p_{mean}, 0.3p_{mean}]$   
 $[p(1-t-r/2), p(1+t+r/2)]$   
 $p_{mean} \quad p=p_{mean}(n+m-1)$   
 $t \quad r$   
 $t=0.4 \quad r=\{0.2, 0.6\}$

Final trial solution 1 : 9 8 1 2 4 6 7 3 5  
 Final trial solution 2 : 1 7 8 2 3 5 9 4 6







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