<table>
<thead>
<tr>
<th>Table Number</th>
<th>Title of the Table</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Process sequences of components of a sample problem</td>
<td>18</td>
</tr>
<tr>
<td>1.2</td>
<td>Machine code and the corresponding value of the index i</td>
<td>19</td>
</tr>
<tr>
<td>1.3</td>
<td>Component code and the corresponding value of the index j</td>
<td>19</td>
</tr>
<tr>
<td>1.4</td>
<td>Different methods used to compute similarity coefficients between a pair of components or machines</td>
<td>38</td>
</tr>
<tr>
<td>1.5</td>
<td>Machine similarity matrix $[s_{ij}]$ of the sample problem</td>
<td>39</td>
</tr>
<tr>
<td>2.1</td>
<td>Classification of machine-component cell formation methods</td>
<td>95</td>
</tr>
<tr>
<td>2.2</td>
<td>Characteristics of machine-component cell design models/algorithms</td>
<td>100</td>
</tr>
<tr>
<td>2.3</td>
<td>Characteristics of the machine-component cell formation models / algorithms proposed in key research publications of the GT literature</td>
<td>105</td>
</tr>
<tr>
<td>3.1</td>
<td>Process sequences of components of the sample problem used to demonstrate ZODIAC algorithm</td>
<td>132</td>
</tr>
<tr>
<td>3.2</td>
<td>Jaccard similarity matrix of machines corresponding to Figure 3.1 used to demonstrate ZODIAC algorithm</td>
<td>133</td>
</tr>
<tr>
<td>3.3</td>
<td>Jaccard similarity matrix of components arrived from Figure 3.2</td>
<td>136</td>
</tr>
</tbody>
</table>
3.4 Intermediate machine-component cells 139
3.5 Intermediate machine-component cells 141
3.6 Tabular explanations for the formation of machine seed, $S_1: (110010)$ 145
3.7 Tabular explanation for the formation of machine seed, $S_2: (001101)$ 146
3.8 Machine similarity matrix of the example problem (Vohra et al. 1990) 149
3.9 Initial machine seeds to cluster components of example problem (Vohra et al. 1990) [output of Hungarian method] 149
3.10 Component families for the example problem (Vohra et al. 1990) using GRAFICS in Iteration 1 151
3.11 Intermediate machine-component cells for example problem (Vohra et al. 1990) using GRAFICS 151
3.12 Component seeds to cluster machines of example problem (Vohra et al. 1990) 152
3.13 Machine cells for example problem (Vohra et al. 1990) using GRAFICS in Iteration 2 152
3.14 Final machine-component cells for example problem (Vohra et al. 1990) using GRAFICS 153
3.15 Details of well-known algorithms 155
3.16 Comparison of ZODIAC (Chandrasekharan and Rajagopalan 1987) and GRAFICS (Srinivasan and Narendran 1991) 156
4.1 Machine similarity matrix of problem 1 199
4.2 Initial machine seeds generated by ESGA using problem 1 and which will be used to cluster components 200
4.3 Component families for problem 1 using ALGORITHM 1 in Iteration 1

4.4 Machine cells for problem 1 using ALGORITHM 1 in Iteration 2

4.5 Final machine-component cells for problem 1 using ALGORITHM 1

4.6 Machine similarity matrix of problem 2

4.7 Initial machine seeds generated by ESGA using problem 2 and which will be used to cluster components

4.8 Component families for problem 2 using ALGORITHM 1 in Iteration

4.9 Machine cells for problem 2 using ALGORITHM 1 in Iteration 2

4.10 Component families for problem 2 using ALGORITHM 1 in Iteration 3

4.11 Final machine-component cells for problem 2 using ALGORITHM 1

4.12 Component families with singleton clusters for problem 2 using ALGORITHM 2 in Iteration 1

4.13 Machine cells with singleton clusters for problem 2 using ALGORITHM 2 in Iteration 2

4.14 Component families with singleton clusters for problem 2 using ALGORITHM 2 in Iteration 3

4.15 Final machine-component cells for problem 2 using ALGORITHM 2

4.16 Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on grouping efficacy as the performance measure
Comparison of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on grouping efficacy ranks

Ranking by grouping efficacy

Frequency distribution of grouping efficacy with two intervals

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on grouping efficiency as the performance measure

Comparison of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on grouping efficiency ranks

Ranking by grouping efficiency

Frequency distribution of grouping efficiency with two intervals

Factors of the experiment

Details about the randomly generated test problems

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on grouping efficacy as the performance measure

ANOVA statistics corresponding to the values of grouping efficacy while comparing algorithms namely ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2

Factors of the experiment

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2 based on modified grouping efficiency
4.30 ANOVA statistics corresponding to the values of modified grouping efficiency while comparing algorithms namely ZODIAC, GRAFICS, ALGORITHM 1 and ALGORITHM 2

5.1 Comparison of final results of SA ALGORITHM and ALGORITHM 2

5.2 Grouping efficacy values obtained using SA ALGORITHM and ALGORITHM 2

5.3 Grouping efficiency values obtained using SA ALGORITHM and ALGORITHM 2

5.4 Recommended machine-component cell design for problem 1 using SA ALGORITHM

5.5 Recommended machine-component cell design for problem 2 using SA ALGORITHM

5.6 Recommended machine-component cell design for problem 3 using SA ALGORITHM

5.7 Recommended machine-component cell design for problem 4 using SA ALGORITHM

5.8 Recommended machine-component cell design for problem 5 using SA ALGORITHM

5.9 Factors of the experiment

5.10 Details about the randomly generated test problems

5.11 Summary of final results of ALGORITHM 2 and SA ALGORITHM based on grouping efficacy as the performance measure

5.12 ANOVA statistics corresponding to the values of grouping efficacy while comparing algorithms namely ALGORITHM 2 and SA ALGORITHM

5.13 Factors of the experiment
Summary of final results of ALGORITHM 2 and SA ALGORITHM based on modified grouping efficiency as the performance measure

ANOVA statistics corresponding to the values of modified grouping efficiency while comparing algorithms namely ALGORITHM 2 and SA ALGORITHM

Factors of the experiment

Details about the randomly generated test problems

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1, ALGORITHM 2 and SA ALGORITHM based on grouping efficacy

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1, ALGORITHM 2 and SA ALGORITHM based on percent deviation with respect to grouping efficacy as the performance measure

ANOVA statistics corresponding to the values of percent deviation with respect to grouping efficacy while comparing algorithms namely ZODIAC, GRAFICS, ALGORITHM 1, ALGORITHM 2 and SA ALGORITHM

Summary of final results of ZODIAC, GRAFICS, ALGORITHM 1, ALGORITHM 2 and SA ALGORITHM based on grouping efficiency

Process sequences of components of the case problem

Machine code and the corresponding value of the index i

Component code and the corresponding value of the index j
6.4 Processing times of each component in different machines 431
6.5 Average production volumes of components per shift 432
6.6 Details regarding setup time, number of setups per shift and number of machines available 433
6.7 Final results of SA ALGORITHM for the case problem 437
6.8 Best set of machine seeds for the case problem 437
6.9 Best machine-component cell design obtained using SA ALGORITHM 438
6.10 Total work load per shift on each machine type 442
6.11 Details about the actual number of machines required in each machine type 443
6.12 Final recommendation 445
6.13 Initial machine seeds to cluster components of the case problem [output of Hungarian method] 448
6.14 Best machine-component cell design obtained using GRAFICS 449
6.15 Best machine-component cell design obtained using ZODIAC 450
IV A 1 Randomly generated annual production volume for the twenty components of T202020b 575
IV A 2 Randomly generated values of the annual availability of the twenty machines of T202020b 577
IV A 3 Randomly generated values of the annual machine operating cost corresponding to the twenty machines of T202020b 582
VA 1 Tabular representation of the generation of first 3 machine seeds (machine groups) by ESGA using machine similarity matrix of problem 1
Initial machine seeds generated by ESGA using problem 1 and which will be used to cluster components.