**Table 1** Parameter setups of machines.

|  |  |  |
| --- | --- | --- |
| Parameters | Range | Construction method |
| *Dj* | [1, 5] | Randomly (number with one decimal place with uniform distribution) |
| *vj* | [0.44, 0.55] | Randomly (number with two decimal places with uniform distribution) |
| *uj* | [15, 21] | Randomly (number with one decimal place with uniform distribution) |
|  | [0.001, 0.0025] | Randomly (number with four decimal places with uniform distribution) |
|  | [0.0015, 0.003] | Randomly (number with four decimal places with uniform distribution) |
|  | [0.01, 0.02] | Randomly (number with three decimal places with uniform distribution) |
| *TPj* | [20, 40] | Randomly (integer with uniform distribution) |
| *TCj* | [60, 120] | Randomly (integer with uniform distribution) |
| *CPj* | 2.5*TPj*+150 | - |
| *CCj* | 2.5*CPj*+1050 | - |
| *Hj* | [0.1, 0.3] | Randomly (number with two decimal places with uniform distribution) |
| *Lj* | [20, 30] | Randomly (integer with uniform distribution) |
| *CPj* | [0.1, 0.2] | Randomly (number with two decimal places with uniform distribution) |

Table 2 Parameter setups of product types.

|  |  |  |
| --- | --- | --- |
| Parameters | Range | Construction method |
| *TRi* | [15, 20] | Randomly (number with one decimal place with uniform distribution) |
| *CRi* | [100, 150] | Randomly (integer with uniform distribution) |
| *CQi* | [10, 20] | Ascending sort (integer with uniform distribution) |
| *Wi* | [75, 100] | Ascending sort (integer with uniform distribution) |
| *hi* | [0.005, 0.01] | Randomly (number with four decimal places with uniform distribution) |
| *CPi* | [1, 2] | Randomly (number with one decimal place with uniform distribution) |
| *Qbi* | [100, 500] | Randomly (integer with uniform distribution) |

**Table 3** Average RPD of CBAM, S\_1, S\_2 and S\_3.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instance | Average RPD | | | | Instance | Average RPD | | | |
| CBAM | S\_1 | S\_2 | S\_3 | CBAM | S\_1 | S\_2 | S\_3 |
| 10×2×3 | **0.0000** | 0.1722 | 0.1591 | 0.6101 | 20×3×5 | **0.0000** | 0.2957 | 0.3738 | 0.8547 |
| 10×2×4 | **0.0000** | 0.2929 | 0.2891 | 0.8165 | 20×4×3 | **0.0000** | 0.2810 | 0.3815 | 0.7607 |
| 10×2×5 | **0.0000** | 0.3923 | 0.4074 | 0.8821 | 20×4×4 | **0.0000** | 0.4125 | 0.5133 | 1.1982 |
| 10×3×3 | **0.0000** | 0.3189 | 0.3096 | 0.7226 | 20×4×5 | **0.0000** | 0.4213 | 0.5390 | 1.0458 |
| 10×3×4 | **0.0000** | 0.4257 | 0.4399 | 0.8635 | 50×2×3 | **0.0000** | 0.2182 | 0.2429 | 0.5288 |
| 10×3×5 | **0.0000** | 0.5725 | 0.5938 | 1.1865 | 50×2×4 | **0.0000** | 0.2011 | 0.2891 | 0.7356 |
| 10×4×3 | **0.0000** | 0.2379 | 0.2860 | 0.5868 | 50×2×5 | **0.0000** | 0.1873 | 0.3751 | 0.9204 |
| 10×4×4 | **0.0000** | 0.2996 | 0.3093 | 0.8388 | 50×3×3 | **0.0000** | 0.2647 | 0.3669 | 0.8998 |
| 10×4×5 | **0.0000** | 0.3843 | 0.4204 | 0.9197 | 50×3×4 | **0.0000** | 0.2050 | 0.2440 | 0.9685 |
| 20×2×3 | **0.0000** | 0.1588 | 0.2200 | 0.5285 | 50×3×5 | **0.0000** | 0.3457 | 0.4541 | 1.1878 |
| 20×2×4 | **0.0000** | 0.2572 | 0.3234 | 0.8643 | 50×4×3 | **0.0000** | 0.2550 | 0.3557 | 0.7904 |
| 20×2×5 | **0.0000** | 0.5300 | 0.7298 | 1.3366 | 50×4×4 | **0.0000** | 0.2672 | 0.3485 | 1.1051 |
| 20×3×3 | **0.0000** | 0.2617 | 0.2817 | 0.7475 | 50×4×5 | **0.0000** | 0.3583 | 0.4978 | 1.4626 |
| 20×3×4 | **0.0000** | 0.3608 | 0.4475 | 0.9364 | Average | **0.0000** | 0.3103 | 0.3777 | 0.8999 |

**Table 4** Average RPD of M\_1, M\_1 and M\_3.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Instance | Average RPD | | | Instance | Average RPD | | |
| M\_1 | M\_2 | M\_3 | M\_1 | M\_2 | M\_3 |
| 10×2×3 | **0.0000** | 0.1304 | 0.2565 | 20×3×5 | **0.0018** | 0.0340 | 0.2593 |
| 10×2×4 | **0.0000** | 0.1904 | 0.2899 | 20×4×3 | 0.0141 | **0.0110** | 0.2101 |
| 10×2×5 | **0.0000** | 0.1756 | 0.2970 | 20×4×4 | 0.0159 | **0.0048** | 0.1863 |
| 10×3×3 | **0.0000** | 0.0781 | 0.2356 | 20×4×5 | **0.0081** | 0.0234 | 0.2798 |
| 10×3×4 | **0.0000** | 0.1544 | 0.2960 | 50×2×3 | 0.0401 | **0.0091** | 0.1585 |
| 10×3×5 | **0.0000** | 0.1805 | 0.4113 | 50×2×4 | **0.0168** | 0.0484 | 0.1940 |
| 10×4×3 | **0.0008** | 0.0445 | 0.1989 | 50×2×5 | **0.0143** | 0.0195 | 0.2431 |
| 10×4×4 | **0.0007** | 0.0467 | 0.2390 | 50×3×3 | 0.0193 | **0.0090** | 0.1256 |
| 10×4×5 | **0.0000** | 0.0836 | 0.3609 | 50×3×4 | **0.0135** | 0.0174 | 0.1692 |
| 20×2×3 | **0.0007** | 0.0332 | 0.1587 | 50×3×5 | 0.0369 | **0.0043** | 0.2508 |
| 20×2×4 | **0.0000** | 0.0994 | 0.2571 | 50×4×3 | 0.0211 | **0.0096** | 0.1276 |
| 20×2×5 | **0.0000** | 0.0793 | 0.3018 | 50×4×4 | 0.0485 | **0.0119** | 0.2398 |
| 20×3×3 | **0.0039** | 0.0142 | 0.1848 | 50×4×5 | **0.0169** | 0.0184 | 0.2064 |
| 20×3×4 | **0.0000** | 0.0517 | 0.2066 | Average | **0.0101** | 0.0588 | 0.2373 |