# Appendixes of Tables

Table . Information of instances

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ins. | *F* | *Mf* | Small. | *n×F×M×T* | Middle. | *n×F×M×T* | Large | *n×F×M×T* |
| C01-C04 | 2 | 2 3 | C01 | 20 x 2 x 5 x 5 | C17 | 60 x 2 x 7 x 5 | C37 | 120 x 2 x 9 x 5 |
| C05-C08 | 3 | 2 3 3 | C02 | 30 x 2 x 5 x 5 | C18 | 70 x 2 x 7 x 5 | C38 | 140 x 2 x 9 x 5 |
| C09-C12 | 4 | 2 3 3 2 | C03 | 40 x 2 x 5 x 5 | C19 | 80 x 2 x 7 x 5 | C39 | 160 x 2 x 9 x 5 |
| C13-C16 | 5 | 2 3 3 3 2 | C04 | 50 x 2 x 5 x 5 | C20 | 90 x 2 x 7 x 5 | C40 | 180 x 2 x 9 x 5 |
| C17-C21 | 2 | 3 4 | C05 | 20 x 3 x 8 x 5 | C21 | 100 x 2 x 7 x 5 | C41 | 200 x 2 x 9 x 5 |
| C22-C26 | 3 | 3 4 4 | C06 | 30 x 3 x 8 x 5 | C22 | 60 x 3 x 11 x 5 | C42 | 120 x 3 x 15 x 5 |
| C27-C31 | 4 | 3 4 4 2 | C07 | 40 x 3 x 8 x 5 | C23 | 70 x 3 x 11 x 5 | C43 | 140 x 3 x 15 x 5 |
| C32-C36 | 5 | 3 4 4 2 5 | C08 | 50 x 3 x 8 x 5 | C24 | 80 x 3 x 11 x 5 | C44 | 160 x 3 x 15 x 5 |
| C37-C41 | 2 | 4 5 | C09 | 20 x 4 x 10 x 5 | C25 | 90 x 3 x 11 x 5 | C45 | 180 x 3 x 15 x 5 |
| C42-C46 | 3 | 4 5 6 | C10 | 30 x 4 x 10 x 5 | C26 | 100 x 3 x 11 x 5 | C46 | 200 x 3 x 15 x 5 |
| C47-C51 | 4 | 4 5 6 3 | C11 | 40 x 4 x 10 x 5 | C27 | 60 x 4 x 13 x 5 | C47 | 120 x 4 x 18 x 5 |
| C52-C56 | 5 | 4 5 6 3 7 | C12 | 50 x 4 x 10 x 5 | C28 | 70 x 4 x 13 x 5 | C48 | 140 x 4 x 18 x 5 |
|  |  |  | C13 | 20 x 5 x 13 x 5 | C29 | 80 x 4 x 13 x 5 | C49 | 160 x 4 x 18 x 5 |
|  |  |  | C14 | 30 x 5 x 13 x 5 | C30 | 90 x 4 x 13 x 5 | C50 | 180 x 4 x 18 x 5 |
|  |  |  | C15 | 40 x 5 x 13 x 5 | C31 | 100 x 4 x 13 x 5 | C51 | 200 x 4 x 18 x 5 |
|  |  |  | C16 | 50 x 5 x 13 x 5 | C32 | 60 x 5 x 18 x 5 | C52 | 120 x 5 x 25 x 5 |
|  |  |  |  |  | C33 | 70 x 5 x 18 x 5 | C53 | 140 x 5 x 25 x 5 |
|  |  |  |  |  | C34 | 80 x 5 x 18 x 5 | C54 | 160 x 5 x 25 x 5 |
|  |  |  |  |  | C35 | 90 x 5 x 18 x 5 | C55 | 180 x 5 x 25 x 5 |
|  |  |  |  |  | C36 | 100 x 5 x 18 x 5 | C56 | 200 x 5 x 25 x 5 |

Table . Experiments of 16 combinations formed under Taguchi method of EMSEA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Trial # | Parameter levels |  |  |  | *IGD* |
| *Popsize* | *Pc* | *Pm* | *Pf* |
| 1 | 1 | 1 | 1 | 1 | 0.058 |
| 2 | 1 | 2 | 2 | 2 | 0.036 |
| 3 | 1 | 3 | 3 | 3 | 0.047 |
| 4 | 1 | 4 | 4 | 4 | 0.049 |
| 5 | 2 | 1 | 2 | 3 | 0.045 |
| 6 | 2 | 2 | 1 | 4 | 0.052 |
| 7 | 2 | 3 | 4 | 1 | 0.052 |
| 8 | 2 | 4 | 3 | 2 | 0.050 |
| 9 | 3 | 1 | 3 | 4 | 0.028 |
| 10 | 3 | 2 | 4 | 3 | 0.045 |
| 11 | 3 | 3 | 1 | 2 | 0.045 |
| 12 | 3 | 4 | 2 | 1 | 0.060 |
| 13 | 4 | 1 | 4 | 2 | 0.048 |
| 14 | 4 | 2 | 3 | 1 | 0.047 |
| 15 | 4 | 3 | 2 | 4 | 0.069 |
| 16 | 4 | 4 | 1 | 3 | 0.055 |

Table . Parameters settings of comparing algorithms

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Algorithm | Key parameters | | | | |
| *Popsize* | *Pc* | *Pm* | *nA* | *nC* |
| NNIA | - | 0.65 | 0.3 | 20 | 100 |
| NSGA-II | 150 | 0.65 | 0.4 | - | - |
| MOEA/D | 150 | 0.65 | 0.3 | - | - |

Table . HV comparison of all algorithms

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Algorithm | C01 | C02 | C03 | C04 | C05 | C06 | C07 | C08 |
| MSEA0 | 0.3482 | 0.1773 | 0.0796 | 0.2173 | 0.3856 | 0.2893 | 0.2668 | 0.1763 |
| MSEA1 | 0.7960 | 0.8175 | 0.8967 | 0.9102 | 0.8718 | 0.7346 | 0.7636 | 0.8464 |
| EMSEA | **0.8215** | **0.8713** | **0.9548** | **0.9512** | **0.9211** | **0.8267** | **0.8153** | **0.9159** |
| NNIA | 0.7655 | 0.8417 | 0.9406 | 0.9305 | 0.8853 | 0.7630 | 0.7769 | 0.8848 |
| NSGA-II | 0.7853 | 0.8373 | 0.9176 | 0.9011 | 0.8437 | 0.7895 | 0.7868 | 0.8877 |
| MOEAD | 0.6442 | 0.6664 | 0.8052 | 0.8653 | 0.7501 | 0.6704 | 0.6570 | 0.7689 |
| Algorithm | C09 | C10 | C11 | C12 | C13 | C14 | C15 | C16 |
| MSEA0 | 0.3861 | 0.3254 | 0.2663 | 0.1755 | 0.4130 | 0.3435 | 0.2797 | 0.1842 |
| MSEA1 | 0.6854 | 0.7251 | 0.7356 | 0.7865 | 0.7714 | 0.7569 | 0.8117 | 0.7878 |
| EMSEA | **0.7872** | **0.7793** | **0.7968** | **0.8527** | **0.8033** | **0.8157** | **0.8462** | **0.8509** |
| NNIA | 0.6587 | 0.7221 | 0.7524 | 0.8131 | 0.7745 | 0.7768 | 0.8155 | 0.7986 |
| NSGA-II | 0.6637 | 0.7201 | 0.7439 | 0.8169 | 0.7650 | 0.7516 | 0.8280 | 0.7941 |
| MOEAD | 0.6239 | 0.6598 | 0.6706 | 0.6850 | 0.7217 | 0.7089 | 0.7654 | 0.7358 |
| Algorithm | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 |
| MSEA0 | 0.0791 | 0.0504 | 0.0382 | 0.0315 | 0.0580 | 0.1929 | 0.1502 | 0.0709 |
| MSEA1 | 0.8270 | 0.8350 | 0.9554 | 0.9180 | 0.8187 | 0.7211 | 0.7896 | 0.7985 |
| EMSEA | **0.9120** | **0.9240** | **0.9762** | **0.9422** | **0.8830** | **0.7744** | **0.8499** | **0.9054** |
| NNIA | 0.8567 | 0.8606 | 0.9544 | 0.9223 | 0.8303 | 0.7517 | 0.7990 | 0.8067 |
| NSGA-II | 0.8241 | 0.8651 | 0.9477 | 0.9212 | 0.8528 | 0.7406 | 0.7986 | 0.8164 |
| MOEAD | 0.7447 | 0.7688 | 0.9023 | 0.8378 | 0.7108 | 0.6399 | 0.6660 | 0.6994 |
| Algorithm | C25 | C26 | C27 | C28 | C29 | C30 | C31 | C32 |
| MSEA0 | 0.1140 | 0.0132 | 0.0883 | 0.1337 | 0.0968 | 0.0765 | 0.1507 | 0.2114 |
| MSEA1 | 0.7449 | 0.8821 | 0.7733 | 0.7666 | 0.8381 | 0.8194 | 0.8701 | 0.6881 |
| EMSEA | **0.8126** | **0.9457** | **0.8495** | **0.8573** | **0.8911** | **0.8713** | **0.9098** | **0.7272** |
| NNIA | 0.7630 | 0.8855 | 0.7896 | 0.7988 | 0.8488 | 0.8422 | 0.8759 | 0.6753 |
| NSGA-II | 0.7678 | 0.9086 | 0.7928 | 0.7902 | 0.8384 | 0.8333 | 0.8721 | 0.6976 |
| MOEAD | 0.6453 | 0.8316 | 0.6380 | 0.6624 | 0.7089 | 0.6848 | 0.7783 | 0.6173 |
| Algorithm | C33 | C34 | C35 | C36 | C37 | C38 | C39 | C40 |
| MSEA0 | 0.1253 | 0.1297 | 0.1301 | 0.0662 | 0.0536 | 0.0428 | 0.0202 | 0.0501 |
| MSEA1 | 0.8229 | 0.6996 | 0.7348 | 0.7765 | 0.8737 | 0.9534 | 0.9683 | 0.8963 |
| EMSEA | **0.8633** | **0.7822** | **0.7811** | **0.8733** | **0.9363** | **0.9778** | **0.9880** | 0.9231 |
| NNIA | 0.7898 | 0.7386 | 0.7270 | 0.7960 | 0.8920 | 0.9625 | 0.9639 | 0.9277 |
| NSGA-II | 0.7997 | 0.7315 | 0.7493 | 0.7999 | 0.8807 | 0.9535 | 0.9700 | 0.9200 |
| MOEAD | 0.7111 | 0.6249 | 0.6115 | 0.7020 | 0.7291 | 0.9128 | 0.9565 | 0.8140 |
| Algorithm | C41 | C42 | C43 | C44 | C45 | C46 | C47 | C48 |
| MSEA0 | 0.0243 | 0.0535 | 0.0724 | 0.0459 | 0.0203 | 0.0148 | 0.0330 | 0.0688 |
| MSEA1 | 0.9403 | 0.8511 | 0.8172 | 0.8768 | 0.9227 | 0.8653 | 0.8132 | 0.8382 |
| EMSEA | **0.9768** | **0.9138** | **0.8725** | **0.9108** | **0.9637** | **0.9085** | **0.8869** | **0.8887** |
| NNIA | 0.9608 | 0.8769 | 0.8285 | 0.8793 | 0.9194 | 0.8754 | 0.8233 | 0.8637 |
| NSGA-II | 0.9606 | 0.8681 | 0.8292 | 0.8839 | 0.9164 | 0.8858 | 0.8148 | 0.8515 |
| MOEAD | 0.8849 | 0.7697 | 0.6987 | 0.7774 | 0.8427 | 0.7512 | 0.7047 | 0.7608 |
| Algorithm | C49 | C50 | C51 | C52 | C53 | C54 | C55 | C56 |
| MSEA0 | 0.0266 | 0.0238 | 0.0224 | 0.0277 | 0.0584 | 0.0786 | 0.0469 | 0.0503 |
| MSEA1 | 0.8566 | 0.8331 | 0.8617 | 0.7503 | 0.8362 | 0.7874 | 0.8024 | 0.8421 |
| EMSEA | **0.9141** | **0.9027** | **0.9265** | **0.8630** | **0.9037** | **0.8572** | **0.8690** | **0.9113** |
| NNIA | 0.8758 | 0.8618 | 0.8782 | 0.7907 | 0.8330 | 0.8206 | 0.8258 | 0.8648 |
| NSGA-II | 0.8807 | 0.8497 | 0.8737 | 0.7787 | 0.8349 | 0.8007 | 0.8402 | 0.8616 |
| MOEAD | 0.7842 | 0.7020 | 0.7871 | 0.6149 | 0.7198 | 0.6972 | 0.7049 | 0.7171 |

Table . Comparison results of splitting mode with normal scheduling on HV

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ins. | *HV* |  |  | Ins. | *HV* |  |  | Ins. | *HV* |  |  | Ins. | *HV* |  |
|  | Split | No Split |  |  | Split | No Split |  |  | Split | No Split |  |  | Split | No Split |
| C01 | **0.7194** | 0.6780 |  | C15 | **0.8093** | 0.6625 |  | C29 | **0.7499** | 0.2319 |  | C43 | **0.7900** | 0.2507 |
| C02 | **0.7649** | 0.5980 |  | C16 | **0.6686** | 0.3666 |  | C30 | **0.6872** | 0.1749 |  | C44 | **0.7611** | 0.0707 |
| C03 | **0.9054** | 0.3028 |  | C17 | **0.8165** | 0.2830 |  | C31 | **0.8383** | 0.3523 |  | C45 | **0.9072** | 0.0597 |
| C04 | **0.7597** | 0.4023 |  | C18 | **0.7863** | 0.1968 |  | C32 | **0.5595** | 0.4429 |  | C46 | **0.7584** | 0.0463 |
| C05 | **0.8324** | 0.4559 |  | C19 | **0.8636** | 0.0501 |  | C33 | **0.7008** | 0.2301 |  | C47 | **0.7284** | 0.1047 |
| C06 | **0.6947** | 0.6180 |  | C20 | **0.8571** | 0.1548 |  | C34 | **0.6414** | 0.3040 |  | C48 | **0.5839** | 0.0341 |
| C07 | **0.6209** | 0.5625 |  | C21 | **0.7357** | 0.2395 |  | C35 | **0.6474** | 0.3660 |  | C49 | **0.7755** | 0.0489 |
| C08 | **0.8054** | 0.3693 |  | C22 | **0.6008** | 0.4944 |  | C36 | **0.6199** | 0.1503 |  | C50 | **0.7388** | 0.0526 |
| C09 | **0.6643** | 0.6119 |  | C23 | **0.8597** | 0.5849 |  | C37 | **0.7395** | 0.0668 |  | C51 | **0.7652** | 0.0302 |
| C10 | **0.7042** | 0.5973 |  | C24 | **0.6466** | 0.0781 |  | C38 | **0.9432** | 0.0764 |  | C52 | **0.7247** | 0.1296 |
| C11 | **0.7196** | 0.6034 |  | C25 | **0.7268** | 0.3406 |  | C39 | **0.9737** | 0.0830 |  | C53 | **0.6571** | 0.0305 |
| C12 | **0.6805** | 0.4351 |  | C26 | **0.8672** | 0.1264 |  | C40 | **0.8225** | 0.0453 |  | C54 | **0.7635** | 0.1769 |
| C13 | 0.6342 | 0.6455 |  | C27 | **0.6905** | 0.2540 |  | C41 | **0.9079** | 0.0132 |  | C55 | **0.5765** | 0.0437 |
| C14 | **0.7381** | 0.6232 |  | C28 | **0.6107** | 0.2565 |  | C42 | **0.7391** | 0.0650 |  | C56 | **0.7555** | 0.0580 |