|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2  Isde+  Isde+-randW1  Isde+-RandW2 | 0.4958 0.0122  0.4947 0.0135  0.4895 0.0153  best =  9 3 2  0.2073 0.0077  0.2090 0.0118  0.2107 0.0121  best =  6 5 6  0.2059 0.0120  0.2152 0.0143  0.2046 0.0114  best =  9 7 5  0.2136 0.0100  0.2072 0.0148  0.2128 0.0127  best =  4 7 10  0.2061 0.0116  0.2120 0.0154  0.2095 0.0108  best =  2 6 1  0.2115 0.0071  0.2073 0.0071  0.2121 0.0122  best =  10 10 8  0.1347 0.0076  0.1358 0.0101  0.1455 0.0140  best =  4 9 1 | 0.9038 0.0074  0.8920 0.0085  0.8916 0.0124  best =  4 10 9  0.5633 0.0125  0.5585 0.0123  0.5556 0.0116  best =  10 6 9  0.5649 0.0170  0.5735 0.0197  0.5690 0.0172  best =  6 7 10  0.5427 0.0717  0.5638 0.0201  0.5604 0.0188  best =  4 7 2  0.2169 0.0102  0.2113 0.0131  0.2197 0.0101  best =  1 2 2  0.2985 0.0164  0.3022 0.0108  0.2946 0.0108  best =  2 9 7  0.1743 0.0132  0.1753 0.0164  0.1727 0.0094  best =  1 2 7 | 0.9666 0.0069  0.9587 0.0156  0.9649 0.0083  best =  3 6 10  0.7402 0.0093  0.7319 0.0103  0.7399 0.0167  best =  1 10 8  0.7335 0.0154  0.7414 0.0076  0.7192 0.0164  best =  1 6 6  0.7331 0.0135  0.7334 0.0292  0.7322 0.0222  best =  7 6 7  0.3187 0.0150  0.3130 0.0136  0.3175 0.0156  best =  4 8 6  0.7683 0.0144  0.7717 0.0150  0.7734 0.0183  best =  5 5 8  0.1451 0.0183  0.1423 0.0127  0.1372 0.0187  best =  8 10 3 | 0.9861 0.0035  0.9808 0.0052  0.9832 0.0039  best =  10 8 9  0.8472 0.0120  0.8315 0.0176  0.8448 0.0139  best =  9 6 5  0.8392 0.0154  0.8345 0.0112  0.8290 0.0220  best =  8 4 2  0.8432 0.0112  0.8463 0.0123  0.8355 0.0160  best =  7 1 7  0.5730 0.0142  0.5581 0.0211  0.5818 0.0195  best =  3 2 6  0.8539 0.0149  0.8551 0.0109  0.8469 0.0160  best =  5 5 6  0.1234 0.0199  0.1123 0.0180  0.1226 0.0230  best =  7 9 3 | 0.9938 0.0032  0.9956 0.0025  0.9961 0.0014  best =  8 7 9  0.9248 0.0084  0.9242 0.0068  0.9191 0.0079  best =  5 8 7  0.9038 0.0092  0.9037 0.0113  0.9031 0.0100  best =  5 2 10  0.9078 0.0109  0.9133 0.0089  0.9204 0.0110  best =  3 5 2  0.5347 0.0181  0.5294 0.0142  0.5326 0.0178  best =  5 10 5  0.8389 0.0138  0.8281 0.0098  0.8319 0.0111  best =  4 2 2  0.1474 0.0171  0.1665 0.0200  0.1582 0.0103  best =  7 2 8 |

Dec 18th: our indicator comparison with indicator with 5 random weight vectors comparison

Hyper volume comparison

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt | 0.4896 0.0154  0.4943 0.0189  best = 19 19  0.2089 0.0148  0.2108 0.0142  best = 16 15  0.2086 0.0128  0.2061 0.0144  best = 13 22  0.2099 0.0129  0.2088 0.0113  best = 18 2  0.2082 0.0139  0.2080 0.0117  best = 17 13  0.2136 0.0135  0.2140 0.0128  best = 24 30  0.1393 0.0083  0.1382 0.0121  best = 27 11 | 0.8988 0.0092  0.9019 0.0108  best = 22 2  0.5659 0.0188  0.5501 0.0149  best = 23 15  0.9924 0.0030  0.9935 0.0034  best = 5 29  0.8603 0.0192  0.8619 0.0159  best = 18 7  0.2342 0.0112  0.2310 0.0167  best = 3 13  0.7379 0.0168  0.7408 0.0191  best = 26 2  0.1778 0.0175  0.1690 0.0137  best = 25 13 | 0.9668 0.0075  0.9658 0.0140  best = 20 3  0.7828 0.0138  0.7667 0.0132  best = 3 20  0.7550 0.0146  0.7200 0.0192  best = 28 17  0.9343 0.0102  0.9273 0.0183  best = 25 27  0.3920 0.0172  0.4121 0.0191  best = 4 1  0.8338 0.0146  0.8437 0.0160  best = 17 1  0.1474 0.0142  0.1235 0.0162  best = 24 23 | 0.9871 0.0042  0.9856 0.0149  best = 17 16  0.8936 0.0092  0.8721 0.0136  best = 15 26  0.8639 0.0130  0.8109 0.0213  best = 19 12  0.9732 0.0061  0.9693 0.0066  best = 9 9  0.5286 0.0189  0.5382 0.0203  best = 1 16  0.8588 0.0130  0.8668 0.0132  best = 24 21  0.1280 0.0155  0.0947 0.0162  best = 23 16 | 0.9962 0.0018  0.9970 0.0024  best = 10 6  0.9638 0.0075  0.9509 0.0091  best = 16 5  0.9250 0.0084  0.9042 0.0162  best = 24 27  0.9946 0.0023  0.9922 0.0025  best = 13 2  0.5764 0.0190  0.5776 0.0141  best = 29 24  0.8754 0.0132  0.8752 0.0120  best = 15 26  0.1147 0.0171  0.0828 0.0170  best = 15 24 |

Same above table with best HV & Mean HV

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt  Isde+  Isde+rand\_5wt | 0.5170  0.5290  0.4945 0.0138  0.4915 0.0138  best = 10 12  0.2360  0.2360  0.2120 0.0130  0.2093 0.0102  best = 2 20  0.2320  0.2290  0.2107 0.0114  0.2017 0.0095  best = 12 29  0.2360  0.2260  0.2112 0.0131  0.2085 0.0097  best = 20 6  0.2420  0.2320  0.2122 0.0113  0.2095 0.0129  best = 12 15  0.2350  0.2430  0.2110 0.0121  0.2125 0.0154  best = 27 14  0.1560  0.1610  0.1402 0.0101  0.1419 0.0107  best = 30 24 | 0.9180  0.9300  0.9008 0.0089  0.9041 0.0106  best = 12 23  0.5960  0.5860  0.5688 0.0162  0.5565 0.0168  best = 3 2  0.9980  0.9970  0.9927 0.0029  0.9929 0.0026  best = 3 18  0.8850  0.8800  0.8581 0.0207  0.8616 0.0162  best = 30 17  0.2530  0.2460  0.2194 0.0149  0.2282 0.0131  best = 4 21  0.7650  0.7680  0.7424 0.0119  0.7380 0.0148  best = 20 9  0.2000  0.1940  0.1758 0.0108  0.1663 0.0126  best = 10 2 | 0.9780  0.9830  0.9666 0.0080  0.9681 0.0157  best = 14 26  0.8150  0.8040  0.7827 0.0126  0.7694 0.0156  best = 1 1  0.7830  0.7640  0.7545 0.0134  0.7194 0.0190  best = 27 25  0.9520  0.9500  0.9347 0.0125  0.9274 0.0186  best = 7 6  0.4270  0.4370  0.3979 0.0139  0.4050 0.0165  best = 22 22  0.8470  0.8800  0.8307 0.0125  0.8450 0.0149  best = 8 11  0.1880  0.1500  0.1514 0.0200  0.1266 0.0147  best = 24 14 | 0.9950  0.9940  0.9877 0.0052  0.9848 0.0105  best = 25 1  0.9180  0.8950  0.8938 0.0075  0.8698 0.0141  best = 24 7  0.8860  0.8580  0.8645 0.0110  0.8138 0.0240  best = 5 17  0.9850  0.9810  0.9758 0.0057  0.9694 0.0067  best = 10 20  0.5510  0.5730  0.5303 0.0153  0.5378 0.0232  best = 4 7  0.8770  0.8810  0.8615 0.0105  0.8655 0.0105  best = 26 14  0.1600  0.1270  0.1323 0.0159  0.0909 0.0166  best = 7 18 | 1  1  0.9963 0.0019  0.9970 0.0021  best = 7 3  0.9770  0.9620  0.9638 0.0075  0.9523 0.0051  best = 29 19  0.9470  0.9310  0.9254 0.0089  0.9004 0.0159  best = 5 29  0.9980  0.9980  0.9930 0.0020  0.9928 0.0032  best = 26 24  0.6200  0.6280  0.5760 0.0188  0.5756 0.0192  best = 30 8  0.8960  0.9000  0.8766 0.0123  0.8782 0.0109  best = 25 28  0.1510  0.1100  0.1144 0.0165  0.0800 0.0155  best = 20 3 |

Different Norms in F-Distance file( 1-Norm,fro\_Norm, Inf\_Norm) 20/12/2017

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm | 0.4932 0.0151  0.4926 0.0150  0.4993 0.0134  0.4963 0.0171  best =29 2 25 7  0.2118 0.0142  0.2106 0.0097  0.2084 0.0116  0.2122 0.0135  best =8 29 25 24  0.2065 0.0114  0.2065 0.0131  0.2079 0.0104  0.2076 0.0143  best = 15 18 3 5  0.2072 0.0108  0.2128 0.0129  0.2100 0.0127  0.2130 0.0122  best = 21 4 2 8  0.2092 0.0160  0.2095 0.0111  0.2135 0.0124  0.2097 0.0110  best = 13 24 9 23  0.2097 0.0126  0.2075 0.0100  0.2124 0.0120  0.2099 0.0147  best = 17 15 10 4  0.1449 0.0086  0.1472 0.0086  0.1381 0.0117  0.1438 0.0084  best = 25 18 2 6 | 0.9010 0.0097  0.9035 0.0069  0.8974 0.0106  0.8973 0.0102  best = 12 25 12 19  0.5584 0.0186  0.5552 0.0172  0.5633 0.0151  0.5618 0.0195  best = 2 19 27 18  0.5672 0.0172  0.5639 0.0149  0.5725 0.0149  0.5783 0.0166  best = 20 21 19 20  0.5571 0.0362  0.5539 0.0306  0.5493 0.0443  0.5617 0.0288  best = 22 1 17 28  0.2110 0.0136  0.2143 0.0141  0.2129 0.0103  0.2094 0.0104  best = 6 6 19 27  0.2800 0.0182  0.2820 0.0161  0.2815 0.0186  0.2850 0.0153  best = 2 15 25 16  0.1763 0.0150  0.1771 0.0145  0.1786 0.0109  0.1759 0.0165  best = 15 10 3 28 | 0.9804 0.0055  0.9844 0.0043  0.9779 0.0065  0.9740 0.0071  best =14 27 16 15  0.7424 0.0152  0.7171 0.0173  0.7436 0.0132  0.7476 0.0114  best = 25 11 7 3  0.7372 0.0172  0.7109 0.0190  0.7386 0.0178  0.7534 0.0135  best = 13 20 3 6  0.7294 0.0273  0.7050 0.0261  0.7275 0.0328  0.7412 0.0352  best =17 26 2 19  0.3354 0.0157  0.3329 0.0206  0.3300 0.0138  0.3304 0.0196  best = 11 7 29 17  0.7731 0.0175  0.7759 0.0153  0.7683 0.0129  0.7699 0.0190  best = 11 6 26 6  0.1526 0.0161  0.1480 0.0165  0.1531 0.0134  0.1568 0.0176  best =15 13 21 29 | 0.9958 0.0038  0.9978 0.0015  0.9952 0.0026  0.9923 0.0060  best = 30 14 20 15  0.8460 0.0120  0.8023 0.0205  0.8494 0.0112  0.8494 0.0128  best = 21 4 7 19  0.8396 0.0150  0.7951 0.0193  0.8410 0.0151  0.8443 0.0157  best = 24 28 11 4  0.8363 0.0209  0.7879 0.0196  0.8335 0.0220  0.8389 0.0241  best = 26 21 28 28  0.4479 0.0128  0.4385 0.0204  0.4447 0.0175  0.4464 0.0160  best = 26 21 13 16  0.8165 0.0120  0.8132 0.0134  0.8169 0.0159  0.8161 0.0157  best = 17 15 2 8  0.1379 0.0161  0.1285 0.0218  0.1411 0.0157  0.1333 0.0146  best = 21 21 22 13 | 0.9974 0.0017  0.9987 0.0011  0.9972 0.0020  0.9958 0.0021  best = 3 30 20 27  0.9224 0.0094  0.8701 0.0143  0.9203 0.0065  0.9267 0.0106  best =20 29 23 23  0.9096 0.0123  0.8647 0.0165  0.9093 0.0113  0.9255 0.0089  best = 22 17 16 3  0.9126 0.0106  0.8700 0.0116  0.9108 0.0084  0.9253 0.0109  best = 20 27 16 15  0.5726 0.0232  0.5540 0.0191  0.5757 0.0161  0.5746 0.0170  best = 20 12 16 6  0.8537 0.0114  0.8492 0.0147  0.8560 0.0146  0.8553 0.0135  best = 28 24 21 12  0.1150 0.0134  0.1224 0.0150  0.1253 0.0207  0.1219 0.0167  best = 7 3 9 1 |

Different norms- Lp norm(=1/M-norm), M-norm included to above table **20/12/2017**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm  Isde+  Isde+\_1-Norm  Isde+\_fro-Norm  Isde+\_inf-Norm  Isde+\_M-Norm  Isde+\_Lp-Norm | 0.4943 0.0156  0.4932 0.0168  0.4980 0.0154  0.4928 0.0207  0.4863 0.0186  0.4881 0.0218  best = 4 21 28 15 12 30  0.2127 0.0130  0.2085 0.0101  0.2075 0.0124  0.2083 0.0146  0.2097 0.0141  0.2115 0.0143  best = 18 14 21 16 10 6  0.2144 0.0120  0.2068 0.0130  0.2102 0.0148  0.2068 0.0118  0.2111 0.0127  0.2072 0.0120  best = 4 14 3 27 20 22  0.2087 0.0117  0.2128 0.0128  0.2114 0.0144  0.2142 0.0125  0.2092 0.0107  0.2085 0.0148  best = 21 6 23 13 15 24  0.2117 0.0145  0.2087 0.0143  0.2081 0.0155  0.2104 0.0158  0.2102 0.0125  0.2118 0.0121  best = 27 1 26 25 9 26  0.2149 0.0128  0.2063 0.0116  0.2113 0.0118  0.2106 0.0138  0.2057 0.0122  0.2161 0.0124  best = 17 10 3 30 23 15  0.1393 0.0120  0.1376 0.0102  0.1412 0.0103  0.1393 0.0120  0.1424 0.0132  0.1409 0.0120  best = 17 12 27 18 22 22 | 0.9026 0.0089  0.9013 0.0093  0.8988 0.0081  0.8975 0.0119  0.8968 0.0119  0.9029 0.0093  best = 19 6 16 10 24 9  0.5632 0.0185  0.5593 0.0172  0.5654 0.0176  0.5712 0.0173  0.5690 0.0160  0.5314 0.0159  best = 7 10 3 8 4 6  0.5679 0.0164  0.5639 0.0157  0.5707 0.0133  0.5710 0.0162  0.5741 0.0179  0.5393 0.0200  best = 5 26 6 10 12 26  0.5525 0.0401  0.5477 0.0335  0.5535 0.0392  0.5643 0.0338  0.5585 0.0372  0.5320 0.0275  best = 16 5 27 12 9 1  0.2127 0.0097  0.2090 0.0126  0.2138 0.0132  0.2100 0.0135  0.2153 0.0127  0.2056 0.0153  best = 19 14 12 1 9 2  0.2840 0.0122  0.2792 0.0164  0.2790 0.0129  0.2837 0.0146  0.2889 0.0131  0.2720 0.0189  best = 20 15 24 12 8 17  0.1771 0.0133  0.1784 0.0156  0.1780 0.0116  0.1730 0.0168  0.1765 0.0117  0.1678 0.0128  best = 16 29 6 29 28 13 | 0.9663 0.0070  0.9728 0.0057  0.9672 0.0056  0.9641 0.0068  0.9662 0.0065  0.9633 0.0072  best = 12 16 28 14 14 17  0.7393 0.0172  0.7176 0.0173  0.7455 0.0140  0.7439 0.0140  0.7497 0.0174  0.4091 0.0738  best = 1 30 11 29 10 23  0.7419 0.0180  0.7100 0.0184  0.7367 0.0158  0.7521 0.0175  0.7545 0.0147  0.5091 0.0698  best = 27 25 25 8 25 28  0.7292 0.0298  0.7050 0.0267  0.7282 0.0265  0.7375 0.0305  0.7367 0.0246  0.5852 0.0263  best = 12 12 3 5 28 17  0.3792 0.0133  0.3755 0.0170  0.3738 0.0164  0.3777 0.0231  0.3718 0.0193  0.3114 0.0170  best = 20 14 30 17 15 15  0.9083 0.0090  0.9091 0.0113  0.9109 0.0080  0.9044 0.0138  0.9056 0.0108  0.8521 0.0723  best = 28 29 23 10 19 20  0.1527 0.0180  0.1504 0.0186  0.1582 0.0153  0.1579 0.0187  0.1618 0.0119  0.1192 0.0213  best = 24 11 27 24 27 8 | 0.9938 0.0039  0.9967 0.0019  0.9942 0.0026  0.9909 0.0058  0.9899 0.0051  0.9629 0.0334  best = 28 25 20 2 3 12  0.8488 0.0117  0.8009 0.0154  0.8495 0.0113  0.8503 0.0078  0.8497 0.0118  0.3731 0.1390  best = 10 13 6 15 20 29  0.8431 0.0120  0.7938 0.0141  0.8424 0.0160  0.8460 0.0102  0.8517 0.0117  0.3832 0.1006  best = 3 27 10 22 30 30  0.8350 0.0177  0.7893 0.0177  0.8345 0.0155  0.8431 0.0226  0.8394 0.0199  0.4939 0.0731  best = 12 6 18 8 7 18  0.4507 0.0165  0.4434 0.0212  0.4472 0.0172  0.4570 0.0169  0.4455 0.0161  0.3692 0.0172  best = 12 4 27 28 5 5  0.9704 0.0061  0.9701 0.0073  0.9699 0.0064  0.9711 0.0052  0.9714 0.0070  0.6936 0.1081  best = 20 18 30 8 12 11  0.1343 0.0109  0.1259 0.0222  0.1393 0.0159  0.1340 0.0150  0.1361 0.0160  0.0903 0.0265  best = 15 26 8 1 2 17 | 0.9968 0.0015  0.9977 0.0017  0.9962 0.0018  0.9944 0.0027  0.9950 0.0021  0.9427 0.0486  best = 13 8 18 12 28 12  0.9239 0.0072  0.8674 0.0159  0.9237 0.0061  0.9250 0.0097  0.9258 0.0092  0.6778 0.0900  best = 12 14 15 13 25 7  0.9034 0.0124  0.8610 0.0149  0.9072 0.0101  0.9235 0.0086  0.9218 0.0122  0.6229 0.1071  best = 2 24 10 28 22 26  0.9138 0.0102  0.8708 0.0133  0.9137 0.0129  0.9245 0.0079  0.9240 0.0104  0.6261 0.0794  best = 6 27 6 25 8 17  0.5918 0.0172  0.5779 0.0183  0.5968 0.0143  0.5949 0.0140  0.5966 0.0167  0.5002 0.0251  best = 3 3 15 8 24 12  0.9726 0.0070  0.9714 0.0102  0.9712 0.0089  0.9722 0.0084  0.9659 0.0156  0.6079 0.1134  best = 5 4 26 4 25 16  0.1191 0.0174  0.1212 0.0193  0.1271 0.0164  0.1236 0.0165  0.1206 0.0171  0.0611 0.0410  best = 22 7 2 6 13 18 |

Date: 29/12/2017: 3.Isde+ with sorting based on each objective and sum of OBJ (f-distance)

**Path:** D:\OUR\_CODES\ISDE+-with\_random5Weights\DTLZ\code-for\_sortingondiffobj\_isde+

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob)  Isde+  Isde+rand\_5wt  Isde+sort(obj+sob) | 0.5260  0.5320  0.5230  0.4915 0.0174  0.4976 0.0143  0.4938 0.0138  best = 3 8 12  0.2380  0.2270  0.2410  0.2095 0.0141  0.2046 0.0118  0.2092 0.0149  best = 21 12 27  0.2460  0.2400  0.2240  0.2087 0.0134  0.2062 0.0149  0.2071 0.0104  best = 16 17 9  0.2450  0.2290  0.2340  0.2108 0.0129  0.2052 0.0110  0.2081 0.0144  best = 19 27 16  0.2360  0.2320  0.2430  0.2077 0.0130  0.2102 0.0100  0.2117 0.0131  best = 13 19 22  0.2360  0.2400  0.2490  0.2070 0.0144  0.2145 0.0141  0.2159 0.0131  best = 2 29 18  0.1670  0.1670  0.1640  0.1384 0.0108  0.1400 0.0128  0.1425 0.0105  best = 29 10 17 | 0.9120  0.9240  0.9240  0.8964 0.0084  0.9032 0.0106  0.9094 0.0090  best = 26 13 8  0.5970  0.5840  0.5880  0.5687 0.0118  0.5571 0.0160  0.5596 0.0163  best = 24 19 26  0.5990  0.6040  0.6040  0.5715 0.0161  0.5594 0.0213  0.5725 0.0161  best = 17 30 12  0.6110  0.6030  0.6010  0.5670 0.0367  0.5615 0.0303  0.5702 0.0348  best = 21 8 9  0.8090  0.8030  0.8020  0.7823 0.0129  0.7802 0.0131  0.7781 0.0104  best = 5 3 4  0.9530  0.9490  0.9470  0.9344 0.0089  0.9361 0.0077  0.9338 0.0090  best = 24 9 5  0.2010  0.1970  0.2050  0.1742 0.0142  0.1669 0.0181  0.1821 0.0167  best = 29 28 30 | 0.9750  0.9870  0.9890  0.9657 0.0065  0.9683 0.0147  0.9770 0.0058  best = 1 7 14  0.8040  0.7920  0.7870  0.7820 0.0122  0.7641 0.0143  0.7629 0.0153  best = 21 17 18  1  1  1  0.9976 0.0020  0.9974 0.0015  0.9970 0.0018  best = 26 26 20  0.8080  0.8100  0.7970  0.7784 0.0242  0.7592 0.0390  0.7656 0.0224  best = 5 24 24  0.8920  0.8980  0.8960  0.8631 0.0122  0.8729 0.0116  0.8745 0.0106  best = 14 4 19  0.9900  0.9950  0.9950  0.9848 0.0040  0.9871 0.0034  0.9877 0.0036  best = 15 17 18  0.1730  0.1660  0.1960  0.1449 0.0163  0.1247 0.0155  0.1617 0.0153  best = 3 14 14 | 0.9960  0.9960  0.9970  0.9875 0.0056  0.9862 0.0132  0.9930 0.0027  best = 28 13 24  0.9560  0.9380  0.9450  0.9410 0.0077  0.9268 0.0077  0.9291 0.0092  best = 27 11 3  1  1  1  0.9998 0.0005  0.9998 0.0005  0.9997 0.0005  best = 30 30 2  0.9020  0.8820  0.8930  0.8805 0.0135  0.8550 0.0182  0.8698 0.0143  best = 4 28 21  0.9010  0.9070  0.9050  0.8802 0.0095  0.8808 0.0113  0.8840 0.0095  best = 16 21 10  0.9960  0.9960  0.9960  0.9903 0.0033  0.9914 0.0026  0.9912 0.0041  best = 18 23 6  0.1620  0.1410  0.1650  0.1324 0.0139  0.0948 0.0189  0.1259 0.0182  best = 16 16 29 | 1  1  1  0.9954 0.0022  0.9968 0.0026  0.9990 0.0009  best = 11 28 4  0.9800  0.9700  0.9770  0.9708 0.0057  0.9616 0.0047  0.9635 0.0056  best = 15 23 29  1  1  1  1.0000 0  1.0000 0.0002  1.0000 0  best = 30 30 10  0.9750  0.9730  0.9720  0.9637 0.0057  0.9526 0.0091  0.9616 0.0068  best = 7 13 12  0.9040  0.9120  0.9090  0.8867 0.0121  0.8853 0.0112  0.8900 0.0125  best = 28 2 19  0.9980  0.9960  0.9960  0.9887 0.0065  0.9911 0.0028  0.9908 0.0024  best = 14 5 29  0.1550  0.1000  0.1590  0.1168 0.0196  0.0791 0.0124  0.1054 0.0209  best = 15 3 11 |

Wfg-isde+ with sorting on each objective and sob

D:\OUR\_CODES\ISDE+-with\_random5Weights\WFG\_sort\_on\_OBJ

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| WFG1  WFG 2  WFG 3  WFG 4  WFG 5  WFG 6  WFG 7  WFG8  WFG9 | Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob)  Isde+  Isde+sort(obj+sob) | 0.7160  0.7090  0.6821 0.0164  0.6842 0.0149  best = 16 16  0.5730  0.5830  0.5444 0.0120  0.5474 0.0163  best = 10 13  0.6120  0.6040  0.5757 0.0144  0.5801 0.0139  best = 1 17  0.4130  0.4080  0.3829 0.0138  0.3858 0.0143  best = 21 17  0.4620  0.4560  0.4276 0.0158  0.4271 0.0142  best = 27 13  0.4840  0.4550  0.4291 0.0197  0.4236 0.0177  best = 19 22  0.4370  0.4460  0.4086 0.0160  0.4072 0.0158  best = 1 24  0.6820  0.6890  0.6301 0.0232  0.6348 0.0245  best = 27 14  0.3940  0.3830  0.3465 0.0213  0.3492 0.0122  best = 23 4 | 0.9830  0.9950  0.9681 0.0064  0.9880 0.0042  best = 2 12  0.6970  0.7070  0.6610 0.0336  0.6653 0.0361  best = 17 10  0.3840  0.3700  0.3548 0.0168  0.3504 0.0140  best =16 28  0.5520  0.5520  0.5089 0.0152  0.5211 0.0162  best =28 18  0.4370  0.4250  0.3981 0.0142  0.3970 0.0166  best =6 27  0.4360  0.4290  0.3771 0.0356  0.3658 0.0336  best =24 12  0.6440  0.6760  0.6097 0.0152  0.6542 0.0106  best =16 19  0.4180  0.4080  0.3676 0.0202  0.3739 0.0212  best =26 5  0.6980  0.7020  0.6469 0.0246  0.6433 0.0329  best =19 3 | 0.9920  1.0000  0.9767 0.0068  0.9970 0.0020  best = 30 21  0.6970  0.7050  0.6533 0.0381  0.6555 0.0365  best =10 1  0.3000  0.2980  0.2652 0.0157  0.2650 0.0140  best =20 9  0.5450  0.5670  0.5087 0.0188  0.5331 0.0131  best =7 14  0.4200  0.4090  0.3890 0.0159  0.3897 0.0137  best =28 4  0.4230  0.4000  0.2469 0.0773  0.2289 0.0890  best =1 14  0.6900  0.7150  0.6603 0.0126  0.6830 0.0156  best =21 3  0.3860  0.3960  0.3549 0.0201  0.3664 0.0142  best =24 26  0.7490  0.7720  0.6726 0.0534  0.6853 0.0442  best =7 5 | 0.9930  1.0000  0.9853 0.0040  0.9986 0.0011  best =19 27  0.7110  0.7290  0.6927 0.0129  0.7040 0.0144  best =24 17  0.2640  0.2580  0.2184 0.0169  0.2180 0.0121  best =5 26  0.7200  0.7230  0.6830 0.0166  0.6934 0.0124  best =17 24  0.4920  0.4960  0.4649 0.0144  0.4566 0.0157  best =29 14  0.4150  0.4770  0.2380 0.1007  0.2416 0.0959  best =30 27  0.7220  0.7290  0.6828 0.0162  0.7055 0.0131  best =1 17  0.3920  0.4030  0.3576 0.0171  0.3721 0.0177  best =16 18  0.9030  0.9070  0.8296 0.0547  0.8209 0.0838  best =4 6 | 0.9980  1.0000  0.9894 0.0044  0.9989 0.0009  best =20 27  0.7170  0.7310  0.6906 0.0162  0.7005 0.0107  best =20 4  0.2300  0.2350  0.2026 0.0158  0.2033 0.0180  best =8 2  0.7220  0.7380  0.6884 0.0156  0.7105 0.0165  best =4 12  0.5020  0.5240  0.4676 0.0162  0.4771 0.0165  best =29 25  0.4560  0.4030  0.1648 0.0811  0.1899 0.0923  best =28 9  0.7290  0.7310  0.6839 0.0198  0.7025 0.0189  best =3 29  0.3910  0.4090  0.3536 0.0213  0.3682 0.0196  best =3 4  0.9270  0.9290  0.8628 0.0528  0.8510 0.0778  best =12 20 |

(05-01-2018) Comparision of \* with 6 algorithms in ISDE+ main Paper:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob) | 0.4256 0.0999  0.4907 0.0167  0.4956 0.0154  0.4931 0.0164  0.4908 0.0179  0.2887 0.0298  0.4914 0.0160  0.4917 0.0186  0.2066 0.0134  0.2125 0.0110  0.2122 0.0133  0.2077 0.0128  0.2105 0.0101  0.2091 0.0108  0.2098 0.0113  0.2085 0.0091  0.2061 0.0133  0.2079 0.0124  0.2070 0.0131  0.2038 0.0169  0.2092 0.0167  0.0000 0.0002  0.2157 0.0121  0.2066 0.0108  0.1761 0.0711  0.0984 0.1057  0.1589 0.0896  0.1868 0.0649  0.1477 0.0922  0.1467 0.0981  0.2104 0.0144  0.2085 0.0098  0.2104 0.0158  0.2077 0.0111  0.2128 0.0139  0.2071 0.0150  0.2131 0.0122  0.2086 0.0159  0.2108 0.0145  0.2130 0.0117  0.2100 0.0142  0.1871 0.0168  0.2072 0.0112  0.2091 0.0140  0.2102 0.0104  0.1998 0.0139  0.2082 0.0139  0.2123 0.0150  0.1332 0.0118  0.1393 0.0093  0.1418 0.0119  0.1198 0.0256  0.1015 0.0238  0.1369 0.0149  0.1415 0.0075  0.1429 0.0105 | 0.7056 0.1589  0.9109 0.0100  0.8979 0.0096  0.8998 0.0084  0.5652 0.1246  0.3750 0.1187  0.9003 0.0086  0.9101 0.0065  0.5874 0.0177  0.5902 0.0135  0.5898 0.0135  0.5785 0.0130  0.5139 0.0190  0.5750 0.0156  0.5815 0.0150  0.5874 0.0152  0.1488 0.1660  0.5816 0.0187  0.5876 0.0151  0.5714 0.0201  0.1466 0.0370  0.0484 0.0069  0.5795 0.0137  0.5787 0.0219  0.5326 0.0810  0.4626 0.1115  0.5418 0.0666  0.5488 0.0730  0.4067 0.1224  0.5551 0.0679  0.5676 0.0405  0.5651 0.0319  0.7771 0.0152  0.7741 0.0133  0.7836 0.0141  0.7809 0.0129  0.7767 0.0123  0.7816 0.0129  0.7813 0.0136  0.7787 0.0128  0.9359 0.0091  0.9340 0.0069  0.9367 0.0065  0.9382 0.0067  0.9262 0.0096  0.9382 0.0078  0.9374 0.0092  0.9330 0.0072  0.1818 0.0142  0.1784 0.0126  0.1967 0.0147  0.1885 0.0115  0.1179 0.0083  0.1885 0.0157  0.1815 0.0162  0.1863 0.0194 | 0.5850 0.2758  0.9775 0.0082  0.9629 0.0074  0.9731 0.0047  0.5277 0.1303  0.4911 0.1047  0.9660 0.0060  0.9767 0.0041  0.7869 0.0132  0.7700 0.0551  0.7901 0.0148  0.7667 0.0138  0.6360 0.0569  0.7992 0.0124  0.7924 0.0172  0.7714 0.0128  0.9893 0.0075  0.9990 0.0047  0.9998 0.0005  0.9989 0.0017  0.9983 0.0050  0.9993 0.0012  0.9998 0.0005  0.9998 0.0005  0.7669 0.0101  0.6503 0.0846  0.7798 0.0142  0.7593 0.0204  0.5696 0.0927  0.7755 0.0368  0.7697 0.0266  0.7550 0.0298  0.8646 0.0107  0.8299 0.0091  0.8662 0.0102  0.8685 0.0123  0.8633 0.0097  0.8776 0.0114  0.8660 0.0106  0.8744 0.0120  0.9831 0.0065  0.9834 0.0056  0.9855 0.0035  0.9807 0.0077  0.9757 0.0049  0.9884 0.0033  0.9855 0.0052  0.9875 0.0031  0.1762 0.0127  0.1316 0.0144  0.1803 0.0141  0.1773 0.0128  0.0934 0.0083  0.1840 0.0158  0.1641 0.0154  0.1814 0.0134 | 0.4219 0.2236  0.9736 0.1051  0.9810 0.0051  0.9912 0.0026  0.5282 0.1089  0.6247 0.0899  0.9873 0.0035  0.9927 0.0030  0.9086 0.0108  0.9092 0.0516  0.9334 0.0082  0.9088 0.0092  0.8067 0.0273  0.9404 0.0073  0.9361 0.0078  0.9248 0.0076  1.0000 0.0002  1.0000 0  1.0000 0  1.0000 0  1.0000 0.0002  1.0000 0  1.0000 0  1.0000 0  0.8593 0.0123  0.8237 0.0802  0.8939 0.0145  0.8729 0.0103  0.6871 0.0402  0.9010 0.0158  0.8879 0.0153  0.8803 0.0141  0.8700 0.0117  0.8381 0.0183  0.8798 0.0134  0.8712 0.0131  0.8827 0.0131  0.8842 0.0105  0.8798 0.0082  0.8843 0.0095  0.9815 0.0080  0.9846 0.0072  0.9891 0.0032  0.9823 0.0104  0.9864 0.0041  0.9902 0.0040  0.9908 0.0032  0.9911 0.0026  0.1228 0.0105  0.0936 0.0219  0.0866 0.0231  0.0788 0.0181  0.0714 0.0123  0.1527 0.0136  0.1455 0.0164  0.1466 0.0187 | 0.4712 0.1885  0.9033 0.2140  0.9938 0.0029  0.9981 0.0013  0.5701 0.1240  0.8368 0.0407  0.9965 0.0021  0.9994 0.0007  0.9587 0.0081  0.9376 0.0333  0.9592 0.0055  0.9353 0.0068  0.7639 0.0350  0.9637 0.0067  0.9589 0.0069  0.9479 0.0081  1 0  1 0  1 0  1 0  1 0  1 0  1 0  1 0  0.9730 0.0057  0.9365 0.0442  0.9742 0.0057  0.9649 0.0058  0.7754 0.0570  0.9771 0.0046  0.9686 0.0057  0.9680 0.0061  0.8603 0.0109  0.8686 0.0134  0.8880 0.0080  0.8817 0.0112  0.8967 0.0071  0.8905 0.0104  0.8828 0.0091  0.8882 0.0103  0.9754 0.0123  0.9867 0.0048  0.9911 0.0031  0.9832 0.0100  0.9900 0.0031  0.9911 0.0037  0.9890 0.0068  0.9919 0.0025  0.0646 0.0201  0.1019 0.0226  0.0361 0.0100  0.0709 0.0132  0.0687 0.0090  0.1390 0.0093  0.1213 0.0170  0.1086 0.0206 |

(06-01-2018) Comparision of \* with 6 algorithms in ISDE+ main Paper: **WFG**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| WFG1  WFG 2  WFG 3  WFG 4  WFG 5  WFG 6  WFG 7  WFG 8  WFG 9 | GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  Isde+sort(obj+sob) | 0.6133 0.0188  0.6190 0.0156  0.6136 0.0135  0.6152 0.0170  0.1427 0.0206  0.6142 0.0125  0.6804 0.0136  0.6882 0.0161  0.4499 0.0152  0.4353 0.0232  0.4554 0.0195  0.4448 0.0158  0.4512 0.0123  0.4467 0.0156  0.5495 0.0174  0.5441 0.0137  0.4910 0.0143  0.4654 0.0165  0.4923 0.0165  0.4882 0.0125  0.4985 0.0139  0.4906 0.0169  0.5744 0.0156  0.5835 0.0132  0.2562 0.0122  0.2496 0.0147  0.2532 0.0133  0.2552 0.0172  0.2551 0.0169  0.2535 0.0155  0.3800 0.0132  0.3808 0.0166  0.3022 0.0150  0.3063 0.0152  0.3087 0.0129  0.3005 0.0102  0.3048 0.0138  0.3025 0.0126  0.4258 0.0137  0.4239 0.0137  0.3032 0.0156  0.3008 0.0157  0.3067 0.0157  0.2999 0.0141  0.3127 0.0142  0.3095 0.0132  0.4249 0.0139  0.4218 0.0128  0.2832 0.0150  0.2118 0.0595  0.2856 0.0147  0.2861 0.0148  0.1816 0.0170  0.2873 0.0138  0.4062 0.0155  0.4030 0.0156  0.4742 0.0204  0.3552 0.0228  0.4725 0.0157  0.4765 0.0165  0.4443 0.0297  0.4805 0.0153  0.5240 0.0209  0.5309 0.0232  0.2192 0.0108  0.2213 0.0140  0.2234 0.0107  0.2208 0.0130  0.2169 0.0137  0.2241 0.0162  0.3391 0.0174  0.3421 0.0154 | 0.9337 0.0115  0.9573 0.0535  0.9748 0.0062  0.9714 0.0072  0.5357 0.0232  0.9568 0.0115  0.9681 0.0063  0.9887 0.0038  0.5773 0.0223  0.5365 0.0696  0.5076 0.0306  0.3786 0.0449  0.5613 0.0278  0.5803 0.0327  0.6591 0.0313  0.6621 0.0364  0.2569 0.0183  0.1910 0.0556  0.2591 0.0136  0.2496 0.0131  0.2671 0.0146  0.2724 0.0136  0.3562 0.0157  0.3576 0.0141  0.3768 0.0148  0.3321 0.0507  0.3689 0.0126  0.3652 0.0143  0.3893 0.0165  0.3602 0.0171  0.5049 0.0155  0.5217 0.0167  0.2497 0.0146  0.2666 0.0120  0.2801 0.0135  0.2707 0.0159  0.2808 0.0149  0.2740 0.0146  0.4032 0.0174  0.4009 0.0144  0.2515 0.0175  0.2718 0.0314  0.2841 0.0201  0.2624 0.0158  0.2825 0.0181  0.2876 0.0160  0.4107 0.0197  0.4049 0.0215  0.4928 0.0144  0.4334 0.0818  0.4976 0.0180  0.4885 0.0176  0.2667 0.0304  0.4832 0.0194  0.6168 0.0164  0.6487 0.0132  0.2243 0.0242  0.2117 0.0207  0.2391 0.0172  0.2220 0.0202  0.2592 0.0171  0.2781 0.0150  0.3537 0.0189  0.3620 0.0238  0.5082 0.0197  0.4732 0.0349  0.5071 0.0240  0.4986 0.0259  0.3041 0.0376  0.5026 0.0252  0.6455 0.0233  0.6390 0.0371 | 0.9689 0.0061  0.9234 0.0761  0.9871 0.0038  0.9853 0.0043  0.6772 0.0227  0.9673 0.0059  0.9779 0.0052  0.9966 0.0023  0.5691 0.0252  0.5001 0.0656  0.5055 0.0358  0.2759 0.0875  0.5667 0.0226  0.5822 0.0301  0.6468 0.0435  0.6601 0.0401  0.1815 0.0131  0.0629 0.0251  0.1718 0.0140  0.1553 0.0134  0.1886 0.0141  0.1913 0.0148  0.2741 0.0129  0.2683 0.0155  0.3712 0.0147  0.2258 0.0850  0.3513 0.0139  0.3423 0.0147  0.3908 0.0188  0.3502 0.0178  0.5143 0.0195  0.5323 0.0151  0.2363 0.0132  0.2379 0.0160  0.2719 0.0146  0.2108 0.0131  0.2756 0.0176  0.2652 0.0122  0.4026 0.0178  0.4032 0.0161  0.1804 0.0535  0.1679 0.0359  0.1988 0.0484  0.1105 0.0361  0.2009 0.0422  0.2008 0.0454  0.3185 0.0486  0.3052 0.0701  0.5326 0.0188  0.4403 0.0909  0.5494 0.0135  0.5400 0.0152  0.1782 0.0236  0.5068 0.0212  0.6585 0.0169  0.6815 0.0164  0.1828 0.0229  0.1133 0.0218  0.1921 0.0163  0.1470 0.0244  0.2102 0.0194  0.2405 0.0176  0.2986 0.0247  0.3153 0.0166  0.5576 0.0381  0.5224 0.0391  0.5692 0.0300  0.5646 0.0300  0.2708 0.0328  0.5267 0.0471  0.6792 0.0515  0.6907 0.0459 | 0.9661 0.0087  0.8814 0.0860  0.9919 0.0033  0.9903 0.0034  0.8285 0.0189  0.9815 0.0056  0.9854 0.0055  0.9986 0.0012  0.6056 0.0168  0.5506 0.0225  0.5576 0.0160  0.2893 0.0664  0.6019 0.0178  0.6155 0.0144  0.6928 0.0130  0.6964 0.0163  0.1658 0.0139  0.0315 0.0202  0.1403 0.0123  0.1025 0.0141  0.1739 0.0099  0.1767 0.0107  0.2394 0.0187  0.2426 0.0167  0.5261 0.0184  0.4335 0.0525  0.4851 0.0181  0.4435 0.0229  0.5447 0.0391  0.5617 0.0179  0.6882 0.0140  0.6953 0.0170  0.2945 0.0159  0.2593 0.0299  0.3389 0.0166  0.2171 0.0210  0.3470 0.0158  0.3050 0.0188  0.4687 0.0143  0.4676 0.0176  0.2087 0.0343  0.1866 0.0578  0.2201 0.0349  0.1261 0.0203  0.2328 0.0427  0.2252 0.0347  0.3422 0.0594  0.3445 0.0485  0.5319 0.0168  0.2882 0.1753  0.5988 0.0181  0.5758 0.0141  0.4859 0.0456  0.5343 0.0147  0.6848 0.0166  0.7097 0.0181  0.1907 0.0199  0.1529 0.0206  0.2016 0.0168  0.1025 0.0154  0.2586 0.0185  0.2445 0.0174  0.3480 0.0150  0.3652 0.0181  0.7008 0.0339  0.6667 0.1258  0.6879 0.0285  0.6630 0.0258  0.2948 0.0365  0.7173 0.0740  0.8295 0.0579  0.8202 0.0843 | 0.9718 0.0074  0.8486 0.1131  0.9940 0.0025  0.9954 0.0017  0.8984 0.0167  0.9858 0.0054  0.9883 0.0045  0.9993 0.0008  0.5932 0.0130  0.5247 0.0336  0.5740 0.0169  0.3701 0.0477  0.6073 0.0152  0.6211 0.0126  0.6965 0.0152  0.7028 0.0163  0.1585 0.0115  0.0008 0.0014  0.1281 0.0075  0.0827 0.0134  0.1634 0.0100  0.1638 0.0103  0.2320 0.0162  0.2342 0.0131  0.5891 0.0171  0.3687 0.1346  0.4526 0.0198  0.4486 0.0304  0.5736 0.0296  0.5944 0.0186  0.6902 0.0148  0.7183 0.0148  0.3129 0.0156  0.2679 0.0268  0.3406 0.0161  0.1480 0.0229  0.3520 0.0147  0.3199 0.0135  0.4807 0.0137  0.4772 0.0153  0.1931 0.0424  0.1420 0.0429  0.2047 0.0383  0.0899 0.0253  0.1979 0.0445  0.2072 0.0525  0.3046 0.0484  0.3190 0.0577  0.5989 0.0173  0.3168 0.1079  0.6413 0.0171  0.6157 0.0164  0.5461 0.0352  0.5524 0.0177  0.6865 0.0196  0.7036 0.0180  0.1732 0.0139  0.1029 0.0233  0.1807 0.0150  0.0700 0.0134  0.2591 0.0179  0.2270 0.0193  0.3347 0.0172  0.3509 0.0220  0.7491 0.0356  0.6945 0.0746  0.7455 0.0288  0.7226 0.0263  0.3179 0.0336  0.7715 0.0670  0.8608 0.0499  0.8535 0.0777 |

For max & MIN ISDE+ (DTLZ-2) on above OBJ+SOB based selection (previously calculated mean ISD+)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| MAX  D-2  MIN  D-2 | GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (mean)Isde+sort(obj+sob)  Max\_Isde+sort(obj+sob)  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (mean)Isde+sort(obj+sob)  Min\_Isde+sort(obj+sob) | 0.2055 0.0135  0.2115 0.0097  0.2086 0.0117  0.2086 0.0130  0.2100 0.0121  0.2083 0.0122  0.2082 0.0125  0.2086 0.0140  0.2109 0.0166  0.2058 0.0127  0.2118 0.0132  0.2147 0.0136  0.2079 0.0105  0.2118 0.0155  0.2079 0.0143  0.2091 0.0130  0.2082 0.0114  0.2110 0.0120 | 0.5934 0.0151  0.5873 0.0162  0.5888 0.0161  0.5828 0.0142  0.5192 0.0184  0.5806 0.0139  0.5840 0.0165  0.5819 0.0151  0.5317 0.0194  0.5879 0.0173  0.5837 0.0161  0.5839 0.0154  0.5782 0.0160  0.5093 0.0196  0.5754 0.0124  0.5802 0.0159  0.5802 0.0190  0.5698 0.0139 | 0.7904 0.0168  0.7727 0.0473  0.7908 0.0108  0.7669 0.0106  0.6319 0.0597  0.7945 0.0147  0.7911 0.0148  0.7751 0.0157  0.6952 0.0207  0.8451 0.0100  0.8351 0.0319  0.8513 0.0116  0.8312 0.0139  0.7380 0.0372  0.8566 0.0094  0.8489 0.0106  0.8356 0.0131  0.8188 0.0126 | 0.9040 0.0095  0.9094 0.0545  0.9360 0.0083  0.9107 0.0114  0.8099 0.0287  0.9427 0.0076  0.9374 0.0083  0.9237 0.0078  0.8475 0.0148  0.9598 0.0050  0.9599 0.0222  0.9724 0.0051  0.9556 0.0082  0.9146 0.0118  0.9746 0.0050  0.9721 0.0048  0.9654 0.0065  0.9624 0.0038 | 0.9578 0.0064  0.9400 0.0325  0.9601 0.0067  0.9335 0.0086  0.7612 0.0391  0.9653 0.0042  0.9583 0.0073  0.9460 0.0078  0.8957 0.0124  0.9911 0.0030  0.9876 0.0068  0.9911 0.0033  0.9826 0.0049  0.9451 0.0131  0.9926 0.0029  0.9917 0.0026  0.9886 0.0031  0.9870 0.0032 |

**Comparison of 13. ISDE+\_(mean)sort(obj+sob) with all the 12 algorithms include ISDE+-org(ours)(09-01-2018)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| D-1  D-2  D-3  D-4  D-5  D-6  D-7 | KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob) | 0.4934 0.0134  0.4709 0.0516  0.1143 0.1942  0 0  0 0  0.4253 0.1038  0.4940 0.0190  0.4947 0.0195  0.4927 0.0165  0.4969 0.0191  0.2892 0.0311  0.4927 0.0138  0.4982 0.0186  0.1712 0.0197  0.2051 0.0172  0.1947 0.0139  0.2061 0.0116  0.0011 0.0038  0.2048 0.0101  0.2128 0.0128  0.2145 0.0148  0.2050 0.0178  0.2112 0.0151  0.2081 0.0121  0.2132 0.0124  0.2109 0.0127  0.0588 0.0172  0.1995 0.0149  0 0  0 0  0 0  0.2055 0.0145  0.2082 0.0172  0.2077 0.0137  0.2012 0.0146  0.2104 0.0135  0.0000 0.0002  0.2055 0.0104  0.2109 0.0127  0.1651 0.0762  0.1629 0.0834  0.1548 0.0798  0.1372 0.0991  0 0  0.1811 0.0736  0.0990 0.1060  0.1597 0.0902  0.1826 0.0631  0.1519 0.0951  0.1488 0.0998  0.2098 0.0123  0.2083 0.0130  0.1736 0.0205  0.2012 0.0145  0.1987 0.0128  0.2015 0.0149  0.0023 0.0065  0.2113 0.0139  0.2063 0.0145  0.2104 0.0122  0.2048 0.0127  0.2123 0.0142  0.2067 0.0147  0.2129 0.0114  0.2072 0.0130  0.1150 0.0187  0.0454 0.0218  0.0081 0.0187  0.1996 0.0392  0 0  0.2064 0.0130  0.1903 0.0153  0.2104 0.0136  0.2117 0.0127  0.2087 0.0157  0.2057 0.0135  0.2092 0.0123  0.2109 0.0141  0.1417 0.0115  0.1377 0.0165  0.0559 0.0390  0.0721 0.0533  0 0  0.1314 0.0112  0.1406 0.0111  0.1391 0.0087  0.1216 0.0277  0.1012 0.0167  0.1373 0.0153  0.1405 0.0085  0.1397 0.0097 | 0.6416 0.1329  0.8143 0.0792  0.0467 0.1268  0 0  0 0  0.7070 0.1613  0.9126 0.0077  0.8942 0.0090  0.9000 0.0098  0.5736 0.1246  0.3821 0.1183  0.9021 0.0106  0.9064 0.0086  0.5553 0.0142  0.5447 0.0158  0.2524 0.0324  0.4597 0.0183  0.0106 0.0118  0.5848 0.0156  0.5813 0.0153  0.5875 0.0161  0.5759 0.0134  0.5078 0.0195  0.5784 0.0143  0.5829 0.0120  0.5774 0.0165  0.4194 0.0772  0.3733 0.1383  0 0  0 0  0 0  0.1513 0.1722  0.5866 0.0166  0.5834 0.0190  0.5733 0.0186  0.1408 0.0417  0.0478 0.0070  0.5786 0.0172  0.5778 0.0143  0.5574 0.0183  0.5390 0.0180  0.3804 0.0609  0.4607 0.0688  0 0  0.5362 0.0847  0.4599 0.1111  0.5480 0.0638  0.5560 0.0746  0.4056 0.1252  0.5593 0.0646  0.5628 0.0336  0.5658 0.0335  0.7684 0.0124  0.7786 0.0114  0.7637 0.0161  0.7587 0.0289  0.6161 0.0295  0.7782 0.0124  0.7758 0.0105  0.7857 0.0118  0.7827 0.0150  0.7797 0.0116  0.7833 0.0097  0.7808 0.0136  0.7780 0.0118  0.9275 0.0117  0.9085 0.0084  0.3024 0.0586  0.9140 0.0226  0.1105 0.0182  0.9377 0.0078  0.9345 0.0073  0.9337 0.0075  0.9382 0.0067  0.9260 0.0072  0.9386 0.0079  0.9373 0.0080  0.9346 0.0059  0.1853 0.0162  0.1809 0.0167  0.0697 0.0453  0.0582 0.0442  0 0  0.1891 0.0112  0.1822 0.0110  0.1938 0.0130  0.1935 0.0108  0.1217 0.0114  0.1958 0.0187  0.1853 0.0154  0.1878 0.0243 | 0.5180 0.1047  0.7752 0.1775  0 0  0 0  0 0  0.5856 0.2733  0.9782 0.0061  0.9616 0.0063  0.9712 0.0049  0.5253 0.1230  0.4939 0.1038  0.9670 0.0071  0.9756 0.0050  0.7329 0.0186  0.7155 0.0188  0.1085 0.0251  0.6297 0.0201  0.0143 0.0094  0.7746 0.0114  0.7560 0.0572  0.7778 0.0124  0.7522 0.0131  0.6022 0.0572  0.7753 0.0158  0.7764 0.0161  0.7610 0.0134  0.9781 0.0124  0.9812 0.0133  0 0  0 0  0 0  0.9886 0.0088  0.9988 0.0047  0.9998 0.0004  0.9987 0.0011  0.9984 0.0045  0.9989 0.0019  0.9998 0.0004  0.9996 0.0006  0.8006 0.0134  0.7959 0.0119  0.4403 0.1206  0.7287 0.0727  0.0034 0.0131  0.8178 0.0138  0.7139 0.0796  0.8255 0.0153  0.8122 0.0166  0.6220 0.1234  0.8240 0.0300  0.8156 0.0226  0.8109 0.0202  0.8613 0.0131  0.8736 0.0106  0.8492 0.0122  0.8164 0.0202  0.7110 0.0173  0.8638 0.0124  0.8288 0.0115  0.8640 0.0132  0.8700 0.0119  0.8659 0.0103  0.8795 0.0096  0.8643 0.0113  0.8735 0.0095  0.9847 0.0047  0.9086 0.0094  0.3445 0.0543  0.9496 0.0143  0.3276 0.1290  0.9848 0.0060  0.9823 0.0057  0.9868 0.0049  0.9793 0.0118  0.9750 0.0053  0.9880 0.0037  0.9856 0.0041  0.9887 0.0035  0.1618 0.0148  0.1732 0.0107  0.0530 0.0295  0.0092 0.0175  0 0  0.1707 0.0115  0.1349 0.0140  0.1797 0.0162  0.1791 0.0126  0.0927 0.0119  0.1819 0.0152  0.1648 0.0169  0.1738 0.0141 | 0.3236 0.1055  0.6696 0.2077  0 0  0 0  0 0  0.4199 0.2179  0.9746 0.1009  0.9781 0.0061  0.9907 0.0037  0.5289 0.1078  0.6192 0.0883  0.9870 0.0046  0.9936 0.0031  0.9632 0.0067  0.9569 0.0060  0.4075 0.1532  0.9394 0.0115  0.3776 0.0399  0.9582 0.0061  0.9587 0.0247  0.9699 0.0042  0.9556 0.0076  0.9101 0.0135  0.9728 0.0053  0.9689 0.0056  0.9652 0.0053  0.6616 0.4520  0.9999 0.0003  0.4977 0.1533  0.9945 0.0132  0.3264 0.1424  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  0.9592 0.0076  0.9607 0.0068  0.6263 0.0794  0.9488 0.0209  0.0560 0.0714  0.9599 0.0060  0.9402 0.0362  0.9674 0.0117  0.9601 0.0068  0.8607 0.0628  0.9682 0.0110  0.9662 0.0085  0.9644 0.0071  0.8645 0.0097  0.8768 0.0093  0.8624 0.0100  0.8304 0.0188  0.7354 0.0248  0.8668 0.0124  0.8371 0.0148  0.8775 0.0110  0.8766 0.0147  0.8831 0.0086  0.8851 0.0100  0.8821 0.0095  0.8830 0.0089  0.9860 0.0041  0.9120 0.0079  0.4002 0.0544  0.9704 0.0101  0.4414 0.0210  0.9828 0.0063  0.9867 0.0060  0.9895 0.0037  0.9822 0.0098  0.9875 0.0040  0.9898 0.0036  0.9896 0.0024  0.9909 0.0030  0.0681 0.0242  0.1372 0.0157  0.0334 0.0298  0.0008 0.0013  0 0  0.1247 0.0117  0.0973 0.0184  0.0861 0.0218  0.0761 0.0173  0.0714 0.0115  0.1537 0.0126  0.1450 0.0140  0.1365 0.0181 | 0.5159 0.2193  0.1874 0.2326  0 0  0 0  0 0  0.4717 0.1862  0.9037 0.2114  0.9942 0.0029  0.9982 0.0012  0.5708 0.1217  0.8362 0.0413  0.9961 0.0024  0.9990 0.0012  0.9745 0.0183  0.9983 0.0012  0.9539 0.0125  0.9974 0.0016  0.7906 0.0169  0.9990 0.0012  0.9986 0.0010  0.9987 0.0012  0.9970 0.0015  0.9930 0.0035  0.9991 0.0009  0.9987 0.0011  0.9987 0.0011  0.9990 0.0044  0.9998 0.0007  0.3931 0.1601  1.0000 0.0002  0.6121 0.0776  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  1.0000 0  0.9996 0.0006  0.9982 0.0013  0.9393 0.0164  0.9995 0.0007  0.5096 0.1303  0.9997 0.0005  0.9987 0.0019  0.9996 0.0006  0.9997 0.0005  0.9915 0.0064  0.9997 0.0005  0.9998 0.0004  0.9997 0.0005  0.8735 0.0135  0.8842 0.0151  0.8680 0.0108  0.8531 0.0141  0.7770 0.0193  0.8597 0.0128  0.8725 0.0104  0.8878 0.0088  0.8822 0.0131  0.8976 0.0080  0.8940 0.0115  0.8844 0.0113  0.8893 0.0111  0.9888 0.0040  0.9087 0.0100  0.4199 0.0409  0.9800 0.0057  0.5302 0.0185  0.9756 0.0140  0.9862 0.0046  0.9916 0.0028  0.9836 0.0092  0.9884 0.0027  0.9910 0.0037  0.9901 0.0061  0.9917 0.0037  0.0330 0.0112  0.1064 0.0147  0.0618 0.0203  0.0015 0.0030  0 0  0.0628 0.0199  0.0965 0.0194  0.0356 0.0088  0.0693 0.0132  0.0703 0.0078  0.1412 0.0139  0.1203 0.0155  0.1089 0.0201 |

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| **DTLZ- OBJECTIVE-2** (ST: statistical test result, best=best run among30) | |
| PROBLEM-1 | ST =0 1 1 1 1 1 0 0 0 0 1 0  best =30 9 7 30 30 18 8 25 15 19 24 10 8  avgrun =27 17 22 15 15 8 14 27 9 25 28 24 23 |
| PROBLEM-2 | ST =1 0 1 0 1 0 0 0 0 0 0 0  best =26 19 6 16 18 14 1 23 27 25 1 19 11  avgrun =16 8 16 4 17 4 20 20 22 21 17 9 3 |
| PROBLEM-3 | ST =1 1 1 1 1 0 0 0 1 0 1 0  best =28 2 30 30 30 5 30 20 13 28 4 2 3  avgrun =10 14 15 15 15 3 1 30 22 17 16 14 25 |
| PROBLEM-4 | ST =1 1 1 1 1 0 1 0 1 0 0 0  best =23 2 1 27 30 6 24 27 10 21 8 12 11  avgrun =10 4 17 19 15 1 26 7 29 30 9 7 22 |
| PROBLEM-5 | ST =1 1 1 0 1 0 0 0 0 0 0 0  best =3 3 15 26 8 13 7 28 30 17 27 23 21  avgrun =27 28 14 24 22 23 25 9 25 14 21 19 26 |
| PROBLEM-6 | ST =1 1 1 0 1 0 1 0 0 0 0 0  best =11 3 20 30 30 15 7 23 26 5 28 6 21  avgrun =4 14 21 13 15 21 20 7 14 12 5 10 27 |
| PROBLEM-7 | ST =0 0 1 1 1 1 0 0 1 1 0 0  best =13 20 3 29 30 17 23 14 14 30 30 20 5  avgrun =25 5 4 3 15 11 6 4 27 1 22 10 11 |
| **DTLZ- OBJECTIVE-4** (ST: statistical test result, best=best run among30) | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 4 29 29 30 30 11 13 14 2 11 9 3 1  avgrun = 24 1 20 15 15 21 3 3 16 23 12 2 3 |
| PROBLEM-2 | ST = 1 1 1 1 1 0 0 1 0 1 0 0  best = 2 22 3 4 11 13 9 25 17 15 14 22 6  avgrun = 10 24 13 3 15 15 16 3 20 13 24 10 25 |
| PROBLEM-3 | ST = 1 1 1 1 1 1 1 0 0 1 1 0  best = 9 22 30 30 30 15 14 19 11 28 3 11 15  avgrun = 16 4 15 15 15 9 29 28 24 29 13 4 22 |
| PROBLEM-4 | ST = 1 1 1 1 1 0 1 0 0 1 0 0  best = 24 2 21 3 30 8 26 17 18 7 22 2 4  avgrun = 11 18 19 15 15 6 24 10 28 30 17 28 29 |
| PROBLEM-5 | ST = 1 0 1 1 1 0 0 1 0 0 0 0  best = 3 16 21 12 15 1 28 9 26 1 10 6 27  avgrun = 24 29 26 22 2 25 18 3 21 22 16 13 5 |
| PROBLEM-6 | ST = 1 1 1 1 1 0 0 0 1 1 0 0  best = 27 17 27 13 11 19 18 10 2 11 8 27 22  avgrun = 29 18 22 23 29 27 1 23 20 23 18 16 7 |
| PROBLEM-7 | ST = 0 0 1 1 1 0 0 0 0 1 0 0  best = 8 20 29 16 30 12 6 21 23 9 2 1 4  avgrun = 3 10 9 20 15 28 7 2 17 30 24 24 27 |
| **DTLZ- OBJECTIVE-6** | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 17 24 30 30 30 20 3 18 19 26 16 20 14  avgrun = 21 11 15 15 15 12 8 26 10 25 30 29 4 |
| PROBLEM-2 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 10 2 29 19 10 5 18 22 8 29 24 16 7  avgrun = 9 29 17 28 15 8 28 11 11 14 9 15 28 |
| PROBLEM-3 | ST = 1 1 1 1 1 1 0 0 1 1 1 0  best = 23 30 30 30 30 9 30 30 29 29 30 29 30  avgrun = 2 6 15 15 15 24 10 12 7 20 14 12 6 |
| PROBLEM-4 | ST = 1 1 1 1 1 0 1 1 0 1 1 0  best = 17 18 21 27 23 19 17 20 6 25 4 20 3  avgrun = 28 5 2 28 18 6 8 24 4 5 9 19 5 |
| PROBLEM-5 | ST = 1 0 1 1 1 1 1 1 0 1 1 1  best = 23 25 2 2 10 24 17 18 28 18 8 9 13  avgrun = 28 10 17 12 4 27 11 24 5 23 2 5 3 |
| PROBLEM-6 | ST = 1 1 1 1 1 1 1 0 1 1 0 1  best = 8 12 26 15 24 9 27 13 17 26 28 2 8  avgrun = 19 18 28 3 23 14 22 9 6 25 16 9 29 |
| PROBLEM-7 | ST = 1 0 1 1 1 0 1 0 0 1 1 0  best = 19 6 27 15 30 23 24 16 7 25 26 24 22  avgrun = 2 29 29 2 15 17 25 2 28 19 24 15 13 |
| **DTLZ- OBJECTIVE-8** | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 0 1 1 1 1 1  best = 15 5 30 30 30 7 24 19 29 2 9 29 28  avgrun = 18 1 15 15 15 16 2 25 10 22 30 11 16 |
| PROBLEM-2 | ST = 0 1 1 1 1 1 0 1 1 1 1 1  best = 26 19 26 14 26 22 18 29 16 19 7 7 26  avgrun = 6 28 10 6 27 12 10 28 6 16 28 6 6 |
| PROBLEM-3 | ST = 1 0 1 1 1 0 0 0 0 0 0 0  best = 27 30 8 30 10 30 30 30 30 30 30 30 30  avgrun = 19 14 13 25 23 15 15 15 15 15 15 15 15 |
| PROBLEM-4 | ST = 1 1 1 1 1 1 0 1 0 1 1 0  best = 28 25 18 8 15 4 27 27 28 13 26 20 16  avgrun = 19 20 23 22 8 17 2 14 26 29 21 28 15 |
| PROBLEM-5 | ST = 1 1 1 1 1 1 1 0 0 0 0 0  best = 26 20 1 9 26 15 13 1 22 10 9 22 7  avgrun = 12 14 11 2 23 8 29 18 5 24 16 25 30 |
| PROBLEM-6 | ST = 1 1 1 1 1 1 1 0 1 1 0 0  best = 21 13 28 30 17 11 24 22 25 23 19 5 4  avgrun = 20 22 30 27 18 28 25 4 20 29 1 29 7 |
| PROBLEM-7 | ST = 1 0 1 1 1 1 1 1 1 1 1 0  best = 8 8 26 2 30 22 17 28 6 20 27 10 15  avgrun = 28 28 6 25 15 17 15 9 2 11 28 4 5 |
| **DTLZ- OBJECTIVE-10** | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 0 1 1 1 1 1  best = 19 13 30 30 30 2 30 14 30 28 25 29 27  avgrun = 17 29 15 15 15 7 7 18 22 15 23 26 15 |
| PROBLEM-2 | ST = 1 0 1 1 1 0 0 0 1 1 0 0  best = 1 30 2 29 11 25 28 30 25 12 28 27 26  avgrun = 4 16 19 26 18 27 30 8 18 22 22 13 12 |
| PROBLEM-3 | ST = 1 0 1 0 1 0 0 0 0 0 0 0  best = 29 30 18 30 24 30 30 30 30 30 30 30 30  avgrun = 10 15 26 14 5 15 15 15 15 15 15 15 15 |
| PROBLEM-4 | ST = 0 1 1 0 1 0 1 0 0 1 0 0  best = 28 22 7 29 25 30 30 29 29 9 29 29 30  avgrun = 6 24 8 4 10 9 20 6 5 22 10 11 10 |
| PROBLEM-5 | ST = 1 0 1 1 1 1 1 0 1 1 0 0  best = 26 22 9 29 16 5 1 29 8 21 22 24 5  avgrun = 23 17 3 10 6 23 25 24 24 5 12 8 12 |
| PROBLEM-6 | ST = 1 1 1 1 1 1 1 0 1 1 0 0  best = 11 29 19 26 15 12 20 20 27 8 23 21 25  avgrun = 6 8 20 27 2 18 4 17 25 23 12 16 19 |
| PROBLEM-7 | ST = 1 0 1 1 1 1 1 1 1 1 1 0  best = 8 25 1 23 30 1 13 10 19 2 16 15 16  avgrun = 20 3 29 26 15 6 11 29 20 23 29 2 7 |

**Comparison of 13. ISDE+\_(mean)sort(obj+sob) with all the 12 algorithms include ISDE+-org(ours)(09-01-2018)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Algorithm | 2 | 4 | 6 | 8 | 10 |
| WFG-1  WFG -2  WFG -3  WFG -4  WFG -5  WFG -6  WFG -7  WFG-8  WFG-9 | KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob)  KnEA  BiGE  Two-ar  MOEA/D  AGE-II  GrEA  NSGA-III  SPEA2+SDE  SRA  HYPE  IBEA  Isde+  (Mean)Isde+sort(obj+sob) | 0.5718 0.0156  0.6059 0.0171  0.6132 0.0140  0.6047 0.0224  0.0827 0.0171  0.6126 0.0132  0.6155 0.0149  0.6227 0.0164  0.6171 0.0136  0.1405 0.0186  0.6193 0.0191  0.6165 0.0185  0.6184 0.0097  0.4462 0.0156  0.4470 0.0204  0.4163 0.0279  0.1683 0.0827  0.0218 0.0164  0.4502 0.0132  0.4337 0.0205  0.4536 0.0125  0.4431 0.0167  0.4497 0.0124  0.4531 0.0133  0.4517 0.0165  0.4522 0.0155  0.4858 0.0166  0.4898 0.0166  0.4825 0.0158  0.3475 0.0623  0.3063 0.0157  0.4894 0.0165  0.4637 0.0187  0.4939 0.0176  0.4876 0.0135  0.4920 0.0125  0.4917 0.0167  0.4915 0.0151  0.4981 0.0147  0.2521 0.0147  0.2447 0.0124  0.2270 0.0130  0.2221 0.0204  0.1414 0.0134  0.2568 0.0125  0.2527 0.0125  0.2497 0.0123  0.2478 0.0113  0.2549 0.0123  0.2516 0.0121  0.2530 0.0144  0.2548 0.0149  0.2728 0.0160  0.2947 0.0146  0.2950 0.0147  0.2867 0.0120  0.2300 0.0131  0.2991 0.0146  0.3078 0.0157  0.3034 0.0136  0.3052 0.0178  0.3098 0.0137  0.3078 0.0168  0.3088 0.0146  0.3033 0.0152  0.3052 0.0140  0.2986 0.0129  0.2980 0.0147  0.2492 0.0309  0.1748 0.0140  0.3025 0.0128  0.3074 0.0141  0.3083 0.0127  0.2996 0.0155  0.3039 0.0192  0.3078 0.0117  0.3079 0.0147  0.3077 0.0141  0.2838 0.0161  0.2844 0.0153  0.2696 0.0202  0.2722 0.0163  0.1159 0.0128  0.2854 0.0156  0.2126 0.0579  0.2862 0.0115  0.2799 0.0161  0.1791 0.0159  0.2838 0.0153  0.2878 0.0161  0.2870 0.0177  0.4578 0.0225  0.4524 0.0187  0.4088 0.0221  0.1956 0.0644  0.0759 0.0216  0.4740 0.0210  0.3560 0.0159  0.4781 0.0210  0.4829 0.0164  0.4433 0.0236  0.4781 0.0211  0.4607 0.0220  0.4704 0.0218  0.2187 0.0110  0.2157 0.0155  0.2127 0.0120  0.2036 0.0162  0.1163 0.0136  0.2201 0.0142  0.2211 0.0139  0.2260 0.0140  0.2200 0.0116  0.2227 0.0130  0.2210 0.0101  0.2219 0.0127  0.2259 0.0122 | 0.9696 0.0064  0.9639 0.0065  0.9768 0.0047  0.9763 0.0048  0.2026 0.0341  0.9340 0.0126  0.9563 0.0545  0.9746 0.0064  0.9700 0.0071  0.5352 0.0242  0.9555 0.0130  0.9624 0.0067  0.9834 0.0039  0.5191 0.0279  0.5793 0.0234  0.0474 0.1061  0 0  0 0  0.5823 0.0246  0.5431 0.0647  0.5034 0.0357  0.3903 0.0439  0.5651 0.0313  0.5851 0.0325  0.5976 0.0247  0.5923 0.0306  0.2621 0.0116  0.2566 0.0163  0.2469 0.0134  0.1470 0.0336  0.1102 0.0092  0.2600 0.0139  0.1883 0.0607  0.2562 0.0132  0.2503 0.0203  0.2675 0.0133  0.2695 0.0159  0.2610 0.0134  0.2636 0.0147  0.3746 0.0151  0.3576 0.0156  0.2457 0.0127  0.2857 0.0181  0.1582 0.0147  0.3789 0.0165  0.3361 0.0486  0.3664 0.0188  0.3639 0.0145  0.3896 0.0155  0.3648 0.0170  0.3741 0.0151  0.3829 0.0139  0.2606 0.0136  0.2666 0.0143  0.2485 0.0112  0.1631 0.0228  0.1874 0.0131  0.2494 0.0137  0.2631 0.0195  0.2756 0.0163  0.2641 0.0133  0.2771 0.0134  0.2733 0.0181  0.2755 0.0132  0.2714 0.0138  0.2137 0.0221  0.2770 0.0198  0.2285 0.0190  0.1179 0.0241  0.0144 0.0087  0.2517 0.0186  0.2711 0.0264  0.2826 0.0182  0.2695 0.0148  0.2884 0.0188  0.2785 0.0198  0.2933 0.0177  0.2886 0.0171  0.4936 0.0132  0.4799 0.0194  0.4506 0.0205  0.4175 0.0254  0.1325 0.0130  0.4949 0.0123  0.4277 0.0743  0.4975 0.0160  0.4934 0.0135  0.2675 0.0340  0.4789 0.0201  0.4990 0.0158  0.5145 0.0159  0.0275 0.0203  0.1803 0.0217  0.0757 0.0253  0.0065 0.0055  0 0  0.1998 0.0282  0.1873 0.0227  0.2126 0.0199  0.1967 0.0235  0.2374 0.0136  0.2547 0.0168  0.2364 0.0205  0.2393 0.0195  0.4998 0.0260  0.4931 0.0275  0.3581 0.0199  0.3480 0.0256  0.1354 0.0155  0.5102 0.0289  0.4659 0.0318  0.5086 0.0257  0.5052 0.0186  0.3015 0.0373  0.5079 0.0287  0.5145 0.0239  0.5106 0.0338 | 0.9866 0.0040  0.9813 0.0052  0.9949 0.0020  0.9958 0.0018  0.2710 0.0255  0.9664 0.0080  0.9258 0.0706  0.9867 0.0049  0.9858 0.0056  0.6805 0.0209  0.9673 0.0067  0.9749 0.0066  0.9957 0.0021  0.4380 0.0566  0.5682 0.0221  0.1557 0.1629  0 0  0 0  0.5730 0.0206  0.5052 0.0626  0.5121 0.0323  0.2779 0.0922  0.5711 0.0291  0.5782 0.0315  0.5820 0.0357  0.5985 0.0327  0.1407 0.0171  0.1655 0.0130  0.1355 0.0145  0.0563 0.0233  0.0152 0.0065  0.1801 0.0135  0.0707 0.0274  0.1739 0.0131  0.1555 0.0147  0.1881 0.0118  0.1953 0.0114  0.1772 0.0141  0.1786 0.0113  0.3418 0.0180  0.3618 0.0145  0.2017 0.0141  0.2530 0.0229  0.1277 0.0131  0.3726 0.0165  0.2284 0.0841  0.3593 0.0203  0.3476 0.0192  0.3971 0.0203  0.3501 0.0136  0.3728 0.0161  0.3868 0.0148  0.1489 0.0246  0.2573 0.0139  0.1903 0.0152  0.1436 0.0226  0.1282 0.0116  0.2393 0.0094  0.2381 0.0119  0.2743 0.0152  0.2319 0.0129  0.2826 0.0145  0.2681 0.0150  0.2776 0.0146  0.2789 0.0117  0.0337 0.0267  0.1929 0.0401  0.0886 0.0326  0.0563 0.0194  0 0  0.1845 0.0462  0.1728 0.0354  0.2061 0.0423  0.1168 0.0326  0.2098 0.0403  0.2078 0.0437  0.2289 0.0392  0.2184 0.0474  0.5458 0.0137  0.5388 0.0182  0.4261 0.0174  0.4300 0.0336  0.0982 0.0109  0.5322 0.0220  0.4361 0.0833  0.5487 0.0159  0.5372 0.0160  0.1750 0.0219  0.5069 0.0190  0.5344 0.0171  0.5508 0.0161  0.0078 0.0060  0.1618 0.0203  0.0468 0.0187  0.0012 0.0027  0 0  0.1743 0.0204  0.1094 0.0222  0.1854 0.0159  0.1418 0.0249  0.1985 0.0193  0.2337 0.0215  0.1995 0.0172  0.2145 0.0154  0.5769 0.0377  0.5892 0.0305  0.4103 0.0241  0.3699 0.0248  0.1320 0.0146  0.5580 0.0328  0.5189 0.0422  0.5694 0.0332  0.5650 0.0282  0.2717 0.0340  0.5247 0.0493  0.5508 0.0560  0.5612 0.0471 | 0.9893 0.0037  0.9876 0.0041  0.9891 0.0037  0.9977 0.0011  0.3928 0.0370  0.9647 0.0091  0.8822 0.0871  0.9917 0.0039  0.9913 0.0029  0.8276 0.0180  0.9826 0.0042  0.9827 0.0047  0.9985 0.0012  0.3912 0.0524  0.5878 0.0158  0.2159 0.1408  0 0  0 0  0.6004 0.0147  0.5597 0.0210  0.5668 0.0219  0.3408 0.0647  0.6098 0.0180  0.6213 0.0154  0.6218 0.0146  0.6360 0.0125  0.0834 0.0133  0.1432 0.0122  0.0862 0.0148  0.0395 0.0276  0.0000 0.0002  0.1599 0.0113  0.0345 0.0185  0.1422 0.0131  0.1053 0.0084  0.1733 0.0119  0.1738 0.0115  0.1455 0.0150  0.1498 0.0125  0.4151 0.0270  0.5416 0.0171  0.2910 0.0177  0.3498 0.0325  0.1919 0.0133  0.5351 0.0191  0.4439 0.0523  0.4804 0.0209  0.4483 0.0236  0.5473 0.0371  0.5612 0.0152  0.5499 0.0156  0.5552 0.0200  0.1811 0.0232  0.3088 0.0138  0.1990 0.0142  0.1693 0.0240  0.1565 0.0132  0.2927 0.0141  0.2675 0.0291  0.3351 0.0127  0.2493 0.0194  0.3456 0.0173  0.3086 0.0139  0.3278 0.0153  0.3284 0.0134 |  |

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| --- | --- |
| **WFG - OBJECTIVE-2** (ST: statistical test result, best=best run among30) | |
| PROBLEM-1 | ST = 1 1 0 1 1 0 0 0 0 1 0 0  best = 16 16 17 22 4 17 24 16 30 10 19 10 6  avgrun = 13 28 23 3 30 16 18 20 28 28 1 15 18 |
| PROBLEM-2 | ST = 0 0 1 1 1 0 1 0 0 0 0 0  best = 6 15 14 29 18 2 20 17 24 2 28 23 3  avgrun = 13 16 4 18 8 10 28 18 20 16 2 5 11 |
| PROBLEM-3 | ST = 1 1 1 1 1 1 1 0 1 0 0 0  best = 3 14 26 3 25 17 21 15 12 27 24 19 11  avgrun = 13 29 1 30 4 10 20 8 25 14 1 4 28 |
| PROBLEM-4 | ST = 0 1 1 1 1 0 0 0 0 0 0 0  best = 16 17 21 7 29 27 7 28 20 9 23 6 23  avgrun = 13 14 9 6 30 18 30 14 16 16 20 24 14 |
| PROBLEM-5 | ST = 1 1 1 1 1 0 0 0 0 0 0 0  best = 7 22 26 9 15 15 27 20 26 4 3 7 28  avgrun = 6 18 30 15 3 19 18 8 2 19 5 14 18 |
| PROBLEM-6 | ST = 0 1 1 1 1 0 0 0 1 0 0 0  best = 30 14 11 29 27 14 6 19 29 16 11 27 12  avgrun = 23 15 9 3 13 30 26 24 19 20 15 30 2 |
| PROBLEM-7 | ST = 0 0 1 1 1 0 1 0 0 1 0 0  best = 2 22 6 13 20 19 18 30 13 16 23 25 25  avgrun = 14 23 19 24 21 7 9 1 17 2 9 22 5 |
| PROBLEM-8 | ST = 1 1 1 1 1 0 1 0 1 1 0 0  best = 22 14 18 24 14 11 10 12 22 25 28 1 14  avgrun = 18 15 9 17 23 10 11 11 2 6 3 23 23 |
| PROBLEM-9 | ST = 1 1 1 1 1 0 0 0 1 0 0 0  best = 14 14 14 18 3 6 29 25 15 15 27 28 5  avgrun = 26 16 24 12 14 2 13 12 19 16 23 18 2 |
| **WFG - OBJECTIVE-4** (ST: statistical test result, best=best run among30) | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 15 3 28 18 24 25 13 15 2 1 5 13 24  avgrun = 4 10 9 2 12 22 16 26 11 25 30 18 28 |
| PROBLEM-2 | ST = 1 1 1 1 1 1 1 1 1 1 0 0  best = 15 27 15 30 30 10 15 1 4 8 26 29 21  avgrun = 13 17 20 15 15 3 3 18 25 17 6 19 3 |
| PROBLEM-3 | ST = 0 0 1 1 1 0 1 0 1 0 0 0  best = 13 14 25 9 12 16 10 8 29 17 17 5 16  avgrun = 18 9 8 26 24 29 17 11 30 3 21 19 9 |
| PROBLEM-4 | ST = 1 1 1 1 1 0 1 1 1 0 1 1  best = 25 17 13 26 13 1 24 19 5 3 2 4 26  avgrun = 29 2 16 16 5 7 3 24 4 26 17 16 2 |
| PROBLEM-5 | ST = 1 0 1 1 1 1 0 0 0 0 0 0  best = 3 18 22 13 28 18 3 24 25 20 22 19 19  avgrun = 16 11 16 22 21 5 19 21 4 14 15 25 23 |
| PROBLEM-6 | ST = 1 1 1 1 1 1 1 0 1 0 1 0  best = 23 2 26 20 16 21 30 27 5 20 7 2 1  avgrun = 18 5 17 13 11 27 10 5 4 23 5 6 7 |
| PROBLEM-7 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 10 1 25 9 5 17 1 14 29 26 11 29 1  avgrun = 8 13 22 27 20 2 28 5 20 28 27 15 5 |
| PROBLEM-8 | ST = 1 1 1 1 1 1 1 1 1 0 1 0  best = 9 5 12 9 30 1 13 16 6 10 10 26 23  avgrun = 15 11 22 10 15 24 30 17 21 7 13 14 20 |
| PROBLEM-9 | ST = 0 0 1 1 1 0 1 0 0 1 0 0  best = 19 21 6 23 7 13 4 30 30 27 28 6 10  avgrun = 1 17 14 11 26 12 5 8 13 26 4 5 7 |
| **WFG - OBJECTIVE-6** | |
| PROBLEM-1 | ST = 1 1 0 0 1 1 1 1 1 1 1 1  best = 2 23 22 26 13 24 9 10 27 30 7 4 14  avgrun = 9 10 25 6 20 18 1 19 23 5 23 22 2 |
| PROBLEM-2 | ST = 1 1 1 1 1 1 1 1 1 1 1 0  best = 30 16 14 30 30 24 17 5 19 30 22 27 21  avgrun = 26 22 27 15 15 28 30 24 30 8 15 8 17 |
| PROBLEM-3 | ST = 1 1 1 1 1 0 1 0 1 1 1 0  best = 6 26 7 14 16 13 11 7 7 1 4 20 7  avgrun = 8 11 14 26 24 11 9 28 25 11 7 23 23 |
| PROBLEM-4 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 1 24 19 14 3 29 21 23 24 2 28 13 25  avgrun = 19 2 6 29 13 11 14 10 18 14 24 1 13 |
| PROBLEM-5 | ST = 1 1 1 1 1 1 1 0 1 0 1 0  best = 25 27 21 9 24 24 6 13 9 7 20 14 11  avgrun = 10 1 20 3 23 19 7 3 10 23 8 23 1 |
| PROBLEM-6 | ST = 1 1 1 1 1 1 1 0 1 0 0 0  best = 18 1 4 27 30 21 15 5 7 27 5 1 19  avgrun = 19 26 29 2 15 5 5 26 10 29 14 9 3 |
| PROBLEM-7 | ST = 0 1 1 1 1 1 1 0 1 1 1 1  best = 2 16 27 21 20 26 8 9 24 20 4 26 17  avgrun = 9 4 12 29 24 15 21 11 25 6 21 12 19 |
| PROBLEM-8 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 30 2 23 18 30 14 3 27 18 17 3 13 18  avgrun = 14 8 24 23 15 12 19 11 21 29 17 8 27 |
| PROBLEM-9 | ST = 0 1 1 1 1 0 1 0 0 1 1 0  best = 28 28 22 20 14 3 18 4 27 28 9 4 5  avgrun = 10 3 7 3 6 19 28 26 17 5 25 9 25 |
| **WFG - OBJECTIVE-8** | |
| PROBLEM-1 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 14 26 6 1 22 14 16 4 19 13 24 11 17  avgrun = 20 14 29 6 19 11 10 22 18 9 15 9 6 |
| PROBLEM-2 | ST = 1 1 1 1 1 1 1 1 1 1 1 1  best = 20 15 10 30 30 7 27 16 27 27 11 18 16  avgrun = 23 27 18 15 15 4 3 21 26 26 3 2 5 |
| PROBLEM-3 | ST = 1 1 1 1 1 1 1 1 1 1 1 0  best = 29 28 20 9 9 6 11 27 6 29 17 11 23  avgrun = 5 26 2 2 16 17 30 16 4 3 23 22 24 |
| PROBLEM-4 | ST = 1 1 1 1 1 1 1 1 1 0 0 0  best = 1 10 5 18 18 25 21 5 17 22 1 3 27  avgrun = 18 23 7 16 26 1 13 8 15 23 6 9 17 |
| PROBLEM-5 | ST = 1 1 1 1 1 1 1 0 1 1 1 0  best = 28 4 4 26 22 6 13 5 4 7 19 7 7  avgrun = 15 17 23 21 20 8 11 23 24 28 24 17 27 |
| PROBLEM-6 |  |
| PROBLEM-7 |  |
| PROBLEM-8 |  |
| PROBLEM-9 |  |
| **WFG- OBJECTIVE-10** | |
| PROBLEM-1 |  |
| PROBLEM-2 |  |
| PROBLEM-3 |  |
| PROBLEM-4 |  |
| PROBLEM-5 |  |
| PROBLEM-6 |  |
| PROBLEM-7 |  |
| PROBLEM-8 |  |
| PROBLEM-9 |  |