

Solving optimization problems via weighted superposition attraction-repulsion algorithm (WSAR)

Adil Baykasoğlu

Dokuz Eylül University, Faculty of Engineering, Department of Industrial Engineering, Izmir, Turkey
E-mail: adil.baykasoglu@deu.edu.tr, Tel: +902323017600, Fax: +902323017608

Table. Computational results for CEC'2020 problems

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|-----------|--------------|-----------|-----------|-----------|
| RC01 | Best | f | 1,89E+02 | 1,89E+02 | 2,80E+02 | 1,89E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,27E+04 | 0,00E+00 | |
| | Median | f | 1,89E+02 | 2,10E+02 | 4,92E+02 | 3,62E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,72E+05 | 3,09E+00 | |
| | Mean | f | 1,89E+02 | 2,17E+02 | 5,25E+02 | 4,85E+02 | |
| | | v | 0,00E+00 | 7,09E-06 | 2,03E+05 | 7,05E+00 | |
| | Worst | f | 1,89E+02 | 2,09E+02 | 8,70E+02 | 9,80E+02 | |
| | | v | 0,00E+00 | 1,13E-04 | 4,86E+05 | 5,14E+01 | |
| | Std. dev. | f | 2,17E-14 | 2,55E+01 | 1,67E+02 | 2,55E+02 | |
| | | v | 0,00E+00 | 2,33E-05 | 1,35E+05 | 1,21E+01 | |
| | Violation | FR | 1,00E+02 | 8,80E+01 | 0,00E+00 | 2,80E-01 | |
| | | C | [000] | [000] | [5 0 0] | [2 1 1] | |
| | RC02 | Best | f | 7,05E+03 | 7,05E+03 | 5,92E+03 | 7,05E+03 |
| | | | v | 0,00E+00 | 0,00E+00 | 5,17E+00 | 0,00E+00 |
| Median | | f | 7,05E+03 | 7,05E+03 | 1,02E+04 | 7,14E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,02E+04 | 0,00E+00 | |
| Mean | | f | 7,05E+03 | 7,05E+03 | 1,25E+04 | 1,38E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,64E+04 | 0,00E+00 | |
| Worst | | f | 7,05E+03 | 7,05E+03 | 4,25E+04 | 1,39E+05 | |
| | | v | 0,00E+00 | 0,00E+00 | 9,94E+04 | 0,00E+00 | |
| Std. dev. | | f | 0,00E+00 | 0,00E+00 | 7,42E+03 | 2,65E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,79E+04 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,00E+02 | |
| | | C | [000] | [000] | [3 0 0] | [000] | |
| RC03 | | Best | f | -4,53E+03 | -4,53E+03 | -1,23E+04 | -4,53E+03 |
| | | | v | 0,00E+00 | 0,00E+00 | 9,48E-01 | 0,00E+00 |
| | Median | f | -4,53E+03 | -4,53E+03 | -6,49E+03 | -4,52E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,55E+02 | 0,00E+00 | |
| | Mean | f | -4,35E+03 | -4,37E+03 | -5,86E+03 | -3,92E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,65E+03 | 0,00E+00 | |
| | Worst | f | -1,43E+02 | -3,72E+03 | 6,15E+01 | -1,33E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,50E+04 | 0,00E+00 | |
| | Std. dev. | f | 8,77E+02 | 3,25E+02 | 3,82E+03 | 1,22E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 6,53E+03 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [5 1 0] | [000] | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|-----------|--------------|-----------|-----------|-----------|
| RC04 | Best | f | -3,88E-01 | -3,88E-01 | -9,46E-01 | -1,47E-02 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,50E-02 | 0,00E+00 | |
| | Median | f | -3,74E-01 | -3,88E-01 | -4,28E-01 | -3,43E-05 | |
| | | v | 0,00E+00 | 0,00E+00 | 6,98E-02 | 0,00E+00 | |
| | Mean | f | -3,76E-01 | -3,87E-01 | -4,78E-01 | -3,16E-03 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,57E-02 | 0,00E+00 | |
| | Worst | f | -3,69E-01 | -3,74E-01 | -3,62E-02 | 0,00E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,96E-01 | 0,00E+00 | |
| | Std. dev. | f | 4,69E-03 | 2,87E-03 | 2,04E-01 | 5,33E-03 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,53E-02 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,00E+02 | |
| | | C | [000] | [000] | [0 1 0] | [000] | |
| | RC05 | Best | f | -4,00E+02 | -4,00E+02 | -1,47E+03 | -7,38E-03 |
| | | | v | 0,00E+00 | 0,00E+00 | 1,06E+01 | 0,00E+00 |
| Median | | f | -3,97E+02 | -3,91E+02 | 9,94E+01 | -1,50E-03 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,66E+01 | 0,00E+00 | |
| Mean | | f | -3,38E+02 | -3,41E+02 | 8,93E+01 | 3,19E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,70E+02 | 0,00E+00 | |
| Worst | | f | 0,00E+00 | -5,74E+00 | 2,35E+03 | 1,00E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 8,98E+02 | 0,00E+00 | |
| Std. dev. | | f | 1,31E+02 | 1,15E+02 | 9,35E+02 | 4,75E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,36E+02 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,00E+02 | |
| | | C | [000] | [000] | [4 0 0] | [000] | |
| RC06 | | Best | f | 1,08E+00 | 2,02E+00 | 1,25E+00 | 1,08E+00 |
| | | | v | 1,33E-01 | 1,92E-02 | 7,84E+00 | 7,96E-02 |
| | Median | f | 1,08E+00 | 2,14E+00 | 1,89E+00 | 1,66E+00 | |
| | | v | 9,37E-02 | 2,16E-02 | 1,08E+01 | 2,76E-01 | |
| | Mean | f | 1,09E+00 | 2,06E+00 | 1,82E+00 | 1,69E+00 | |
| | | v | 1,52E-01 | 2,18E-02 | 1,15E+01 | 3,54E-01 | |
| | Worst | f | 1,11E+00 | 2,16E+00 | 2,38E+00 | 2,41E+00 | |
| | | v | 1,12E-01 | 2,52E-02 | 1,80E+01 | 7,92E-01 | |
| | Std. dev. | f | 7,43E-03 | 1,04E-01 | 3,07E-01 | 4,48E-01 | |
| | | v | 1,24E-01 | 1,58E-03 | 2,92E+00 | 2,01E-01 | |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | | C | [0 1 0] | [0 3 5] | [11 8 0] | [0 17 1] | |
| | RC07 | Best | f | 9,51E-01 | 2,04E+00 | 1,07E+00 | 1,20E+00 |
| | | | v | 1,01E-01 | 3,92E-03 | 2,68E+00 | 2,87E-01 |
| Median | | f | 1,09E+00 | 2,18E+00 | 1,68E+00 | 1,49E+00 | |
| | | v | 5,12E-01 | 1,79E-02 | 5,07E+00 | 5,08E-01 | |
| Mean | | f | 1,16E+00 | 1,84E+00 | 1,74E+00 | 1,50E+00 | |
| | | v | 1,81E-01 | 3,98E-02 | 4,93E+00 | 7,00E-01 | |
| Worst | | f | 1,60E+00 | 1,70E+00 | 2,58E+00 | 1,92E+00 | |
| | | v | 1,68E-01 | 5,33E-01 | 8,16E+00 | 1,51E+00 | |
| Std. dev. | | f | 1,95E-01 | 1,95E-01 | 3,81E-01 | 1,97E-01 | |
| | | v | 1,92E-01 | 1,01E-01 | 1,32E+00 | 4,31E-01 | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR |
|-----------|-------------|----------|----------|--------------|----------|----------|
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [0 6 2] | [15 5 0] | [0 24 0] |
| RC08 | Best | f | 2,00E+00 | 2,00E+00 | 2,00E+00 | 2,00E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,00E+00 | 2,00E+00 | 2,00E+00 | 2,00E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 2,00E+00 | 2,00E+00 | 2,05E+00 | 2,00E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Worst | f | 2,00E+00 | 2,00E+00 | 2,24E+00 | 2,00E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Std. dev. | f | 0,00E+00 | 0,00E+00 | 9,42E-02 | 1,11E-16 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | C | [000] | [000] | [000] | [000] | |
| RC09 | Best | f | 2,56E+00 | 2,56E+00 | 2,58E+00 | 2,56E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,56E+00 | 2,56E+00 | 3,62E+00 | 2,56E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 2,56E+00 | 2,56E+00 | 3,44E+00 | 2,59E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 4,99E-03 | 0,00E+00 |
| | Worst | f | 2,56E+00 | 2,56E+00 | 3,95E+00 | 3,39E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 1,09E-01 | 0,00E+00 |
| | Std. dev. | f | 1,36E-15 | 0,00E+00 | 4,10E-01 | 1,65E-01 |
| | | v | 0,00E+00 | 0,00E+00 | 2,19E-02 | 0,00E+00 |
| Violation | FR | 1,00E+02 | 1,00E+02 | 0,88E+02 | 1,00E+02 | |
| | C | [000] | [000] | [000] | [000] | |
| RC010 | Best | f | 1,08E+00 | 1,08E+00 | 1,07E+00 | 1,08E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 1,08E+00 | 1,08E+00 | 1,25E+00 | 1,08E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 1,15E+00 | 1,10E+00 | 1,19E+00 | 1,08E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 2,40E-05 | 0,00E+00 |
| | Worst | f | 1,25E+00 | 1,25E+00 | 1,35E+00 | 1,16E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 5,99E-04 | 0,00E+00 |
| | Std. dev. | f | 8,79E-02 | 6,36E-02 | 1,14E-01 | 1,64E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 1,20E-04 | 0,00E+00 |
| Violation | FR | 1,00E+02 | 1,00E+02 | 0,96E+02 | 1,00E+02 | |
| | C | [000] | [000] | [000] | [000] | |
| RC011 | Best | f | 9,92E+01 | 1,08E+02 | 9,93E+01 | 1,00E+02 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 1,07E+02 | 1,68E+02 | 1,50E+02 | 1,20E+02 |
| | | v | 0,00E+00 | 1,25E-01 | 1,84E-01 | 3,15E-05 |
| | Mean | f | 1,05E+02 | 1,48E+02 | 1,42E+02 | 1,29E+02 |
| | | v | 0,00E+00 | 9,50E-02 | 2,03E-01 | 2,14E-02 |
| | Worst | f | 1,07E+02 | 1,52E+02 | 2,09E+02 | 2,34E+02 |
| | | v | 0,00E+00 | 1,25E-01 | 4,27E-01 | 3,38E-01 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR |
|----------|-------------|----|----------|--------------|----------|----------|
| | Std. dev. | f | 3,73E+00 | 2,08E+01 | 2,71E+01 | 2,99E+01 |
| | | v | 0,00E+00 | 5,34E-02 | 1,52E-01 | 7,64E-02 |
| | Violation | FR | 1,00E+02 | 2,40E+01 | 0,12E+02 | 3,60E-01 |
| | | C | [000] | [0 1 0] | [2 0 1] | [0 0 1] |
| RC012 | Best | f | 2,92E+00 | 2,92E+00 | 2,85E+02 | 2,92E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 3,30E+01 | 0,00E+00 |
| | Median | f | 2,92E+00 | 2,92E+00 | 6,01E+31 | 2,92E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 1,74E+02 | 0,00E+00 |
| | Mean | f | 2,92E+00 | 2,92E+00 | 6,55E+04 | 3,03E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 2,55E+02 | 0,00E+00 |
| | Worst | f | 2,92E+00 | 2,92E+00 | 6,55E+04 | 4,21E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 9,64E+02 | 0,00E+00 |
| | Std. dev. | f | 4,53E-16 | 4,44E-16 | 3,44E+03 | 3,53E-01 |
| | | v | 0,00E+00 | 0,00E+00 | 2,16E+02 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,00E+02 |
| | | C | [000] | [000] | [7 0 0] | [000] |
| RC013 | Best | f | 2,69E+04 | 2,69E+04 | 2,60E+04 | 2,69E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,69E+04 | 2,69E+04 | 2,95E+04 | 2,69E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 2,69E+04 | 2,69E+04 | 2,92E+04 | 2,69E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 9,72E-02 | 0,00E+00 |
| | Worst | f | 2,69E+04 | 2,69E+04 | 3,14E+04 | 2,69E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 5,02E-01 | 0,00E+00 |
| | Std. dev. | f | 1,11E-11 | 3,64E-12 | 1,41E+03 | 3,80E-08 |
| | | v | 0,00E+00 | 0,00E+00 | 1,55E-01 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,6E+01 | 1,00E+02 |
| | | C | [000] | [000] | [000] | [000] |
| RC014 | Best | f | 5,85E+04 | 5,85E+04 | 7,26E+04 | 5,36E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 5,85E+04 | 5,85E+04 | 1,26E+05 | 5,37E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 5,85E+04 | 5,85E+04 | 1,25E+05 | 5,47E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 5,61E+00 | 0,00E+00 |
| | Worst | f | 5,85E+04 | 5,85E+04 | 1,82E+05 | 5,93E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 7,71E+01 | 0,00E+00 |
| | Std. dev. | f | 8,06E-09 | 7,28E-12 | 2,73E+04 | 2,12E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 1,93E+01 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,72E+02 | 1,00E+02 |
| | | C | [000] | [000] | [000] | [000] |
| RC015 | Best | f | 2,99E+03 | 2,99E+03 | 3,34E+03 | 2,99E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,99E+03 | 2,99E+03 | 4,44E+03 | 2,99E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 2,67E-02 | 0,00E+00 |
| | Mean | f | 2,99E+03 | 2,99E+03 | 4,54E+03 | 2,99E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 3,96E-02 | 0,00E+00 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR |
|----------|-------------|----|----------|--------------|----------|----------|
| | Worst | f | 2,99E+03 | 2,99E+03 | 6,32E+03 | 2,99E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 1,86E-01 | 0,00E+00 |
| | Std. dev. | f | 4,64E-13 | 4,55E-13 | 6,70E+02 | 3,21E-10 |
| | | v | 0,00E+00 | 0,00E+00 | 4,04E-02 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,08E+01 | 1,00E+02 |
| | | C | [000] | [000] | [0 1 0] | [000] |
| RC016 | Best | f | 3,22E-02 | 3,22E-02 | 2,78E+05 | 3,22E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 4,39E-01 | 0,00E+00 |
| | Median | f | 3,22E-02 | 3,22E-02 | 6,30E+06 | 3,22E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 1,86E+00 | 0,00E+00 |
| | Mean | f | 3,22E-02 | 3,22E-02 | 8,52E+06 | 1,04E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 1,94E+00 | 3,68E-02 |
| | Worst | f | 3,22E-02 | 3,22E-02 | 2,34E+07 | 1,21E+04 |
| | | v | 0,00E+00 | 0,00E+00 | 3,81E+00 | 2,41E-01 |
| | Std. dev. | f | 3,17E-18 | 0,00E+00 | 6,42E+06 | 3,02E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 8,48E-01 | 7,00E-02 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 7,60E-01 |
| | | C | [000] | [000] | [2 3 0] | [000] |
| RC017 | Best | f | 1,27E-02 | 1,27E-02 | 1,12E-02 | 1,27E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 1,27E-02 | 1,27E-02 | 8,91E-02 | 1,27E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 1,27E-02 | 1,27E-02 | 2,77E-01 | 1,27E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 6,23E-02 | 0,00E+00 |
| | Worst | f | 1,27E-02 | 1,27E-02 | 1,01E+00 | 1,27E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 1,99E-01 | 0,00E+00 |
| | Std. dev. | f | 2,01E-05 | 1,06E-07 | 3,18E-01 | 2,30E-05 |
| | | v | 0,00E+00 | 0,00E+00 | 8,70E-02 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,56E+02 | 1,00E+02 |
| | | C | [000] | [000] | [000] | [000] |
| RC018 | Best | f | 6,06E+03 | 6,06E+03 | 1,18E+04 | 6,06E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 6,06E+03 | 6,06E+03 | 3,01E+04 | 6,06E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Mean | f | 6,06E+03 | 6,06E+03 | 3,12E+04 | 6,06E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Worst | f | 6,06E+03 | 6,09E+03 | 6,40E+04 | 6,06E+03 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Std. dev. | f | 9,28E-13 | 8,36E+00 | 1,30E+04 | 4,60E-02 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 |
| | | C | [000] | [000] | [000] | [000] |
| RC019 | Best | f | 1,67E+00 | 1,67E+00 | 2,85E+00 | 1,67E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 1,67E+00 | 1,67E+00 | 4,54E+00 | 1,67E+00 |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| | Mean | f | 1,67E+00 | 1,67E+00 | 4,49E+00 | 1,67E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 1,67E+00 | 1,67E+00 | 7,32E+00 | 1,67E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 0,00E+00 | 0,00E+00 | 1,02E+00 | 7,50E-16 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| RC020 | Best | f | 2,64E+02 | 2,64E+02 | 2,64E+02 | 2,64E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Median | f | 2,64E+02 | 2,64E+02 | 2,65E+02 | 2,64E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | 2,64E+02 | 2,64E+02 | 2,65E+02 | 2,64E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 2,64E+02 | 2,64E+02 | 2,69E+02 | 2,64E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 0,00E+00 | 0,00E+00 | 1,42E+00 | 3,00E-06 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC021 | Best | f | 2,35E-01 | 2,35E-01 | 2,37E-01 | 2,35E-01 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Median | | f | 2,35E-01 | 2,35E-01 | 4,21E-01 | 2,35E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Mean | | f | 2,35E-01 | 2,35E-01 | 4,35E-01 | 2,35E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Worst | | f | 2,35E-01 | 2,35E-01 | 6,86E-01 | 2,35E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Std. dev. | | f | 1,13E-16 | 0,00E+00 | 1,12E-01 | 1,15E-16 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| RC022 | | Best | f | 5,26E-01 | 5,26E-01 | 6,44E-01 | 5,26E-01 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 5,26E-01 | 5,30E-01 | 1,75E+00 | 5,30E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,07E+00 | 0,00E+00 | |
| | Mean | f | 5,27E-01 | 5,41E-01 | 2,04E+00 | 5,32E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,25E+00 | 0,00E+00 | |
| | Worst | f | 5,31E-01 | 7,47E-01 | 8,05E+00 | 5,37E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,25E+01 | 0,00E+00 | |
| | Std. dev. | f | 1,44E-03 | 4,26E-02 | 1,58E+00 | 5,00E-03 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,61E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,24E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [4 0 1] | [000] | |
| | RC023 | Best | f | 1,61E+01 | 1,61E+01 | 3,55E+00 | 1,62E+01 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| | Median | f | 1,61E+01 | 1,61E+01 | 8,47E+00 | 1,69E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,00E+01 | 0,00E+00 | |
| | Mean | f | 1,61E+01 | 1,61E+01 | 8,82E+00 | 1,69E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,38E+01 | 0,00E+00 | |
| | Worst | f | 1,61E+01 | 1,61E+01 | 1,52E+01 | 1,76E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 8,05E+01 | 0,00E+00 | |
| | Std. dev. | f | 3,33E-14 | 0,00E+00 | 3,34E+00 | 2,64E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,56E+01 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,08E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [2 0 0] | [000] | |
| | RC024 | Best | f | 2,54E+00 | 2,54E+00 | 5,38E+00 | 2,54E+00 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Median | | f | 2,54E+00 | 2,54E+00 | 3,40E+01 | 2,56E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,48E+00 | 0,00E+00 | |
| Mean | | f | 2,54E+00 | 2,54E+00 | 3,61E+05 | 2,64E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,32E+01 | 0,00E+00 | |
| Worst | | f | 2,54E+00 | 2,54E+00 | 9,02E+06 | 4,29E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 6,98E+01 | 0,00E+00 | |
| Std. dev. | | f | 1,35E-12 | 0,00E+00 | 1,80E+06 | 3,45E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,93E+01 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 0,32E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| RC025 | Best | f | 1,62E+03 | 1,62E+03 | 2,73E+03 | 1,62E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Median | f | 1,62E+03 | 1,62E+03 | 5,93E+03 | 1,71E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,23E-03 | 0,00E+00 | |
| | Mean | f | 1,62E+03 | 1,64E+03 | 6,14E+03 | 1,76E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 9,05E-01 | 0,00E+00 | |
| | Worst | f | 1,62E+03 | 2,13E+03 | 1,58E+04 | 2,23E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 8,02E+00 | 0,00E+00 | |
| | Std. dev. | f | 1,78E-11 | 1,01E+02 | 2,73E+03 | 1,55E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,88E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 4,80E+01 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| RC026 | Best | f | 3,54E+01 | 3,54E+01 | 6,04E+01 | 4,55E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,17E+00 | 4,15E-02 | |
| | Median | f | 3,54E+01 | 3,62E+01 | 2,04E+02 | 9,61E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,45E+01 | 1,18E+00 | |
| | Mean | f | 3,57E+01 | 3,66E+01 | 2,12E+02 | 1,06E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,35E+01 | 1,35E+00 | |
| | Worst | f | 3,73E+01 | 4,09E+01 | 3,60E+02 | 2,02E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,09E+02 | 3,76E+00 | |
| | Std. dev. | f | 5,99E-01 | 1,37E+00 | 8,09E+01 | 3,74E+01 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,95E+01 | 1,00E+02 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 0,00E+00 | |
| | | C | [000] | [000] | [8 0 0] | [5 2 0] | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| RC027 | Best | f | 5,24E+02 | 5,24E+02 | 6,14E+02 | 5,25E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Median | f | 5,24E+02 | 5,24E+02 | 7,08E+02 | 5,25E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | 5,24E+02 | 5,24E+02 | 7,07E+02 | 5,25E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 5,24E+02 | 5,24E+02 | 7,89E+02 | 5,25E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 3,76E-07 | 0,00E+00 | 5,22E+01 | 4,90E-02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC028 | Best | f | 1,70E+04 | 1,70E+04 | 2,06E+04 | 1,70E+04 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Median | | f | 1,70E+04 | 1,70E+04 | 4,07E+04 | 1,70E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,44E-01 | 0,00E+00 | |
| Mean | | f | 1,70E+04 | 1,70E+04 | 3,90E+04 | 1,70E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 5,68E-01 | 0,00E+00 | |
| Worst | | f | 1,70E+04 | 1,70E+04 | 6,55E+04 | 1,70E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,73E+00 | 0,00E+00 | |
| Std. dev. | | f | 3,71E-12 | 0,00E+00 | 1,14E+04 | 2,50E-08 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,43E-01 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 4,00E-02 | 1,00E+02 | |
| | | C | [000] | [000] | [2 0 0] | [000] | |
| RC029 | | Best | f | 2,96E+06 | 2,96E+06 | 3,70E+06 | 2,96E+06 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,96E+06 | 2,96E+06 | 8,40E+06 | 2,96E+06 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | 2,96E+06 | 2,96E+06 | 8,39E+06 | 2,96E+06 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 2,96E+06 | 2,96E+06 | 1,15E+07 | 2,96E+06 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 1,43E-09 | 0,00E+00 | 2,00E+06 | 1,76E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC030 | Best | f | 2,66E+00 | 2,66E+00 | 2,80E+00 | 2,66E+00 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Median | | f | 2,66E+00 | 2,66E+00 | 6,25E+00 | 2,66E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Mean | | f | 2,81E+00 | 2,66E+00 | 1,32E+01 | 2,66E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,26E+03 | 0,00E+00 | |
| Worst | | f | 3,64E+00 | 2,70E+00 | 8,23E+01 | 2,66E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 3,79E+04 | 0,00E+00 | |
| Std. dev. | | f | 3,66E-01 | 1,11E-02 | 1,86E+01 | 3,04E-08 | |
| | | v | 0,00E+00 | 0,00E+00 | 8,24E+03 | 0,00E+00 | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|-----------|--------------|-----------|-----------|-----------|
| | Violation | FR | 1,00E+02 | 1,00E+02 | 6,40E+01 | 1,00E+02 | |
| | | C | [000] | [000] | [1 2 0] | [000] | |
| RC031 | Best | f | 0,00E+00 | 0,00E+00 | 1,72E-20 | 1,58E-18 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Median | f | 0,00E+00 | 0,00E+00 | 1,40E-05 | 1,50E-16 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | 0,00E+00 | 1,88E-16 | 3,80E-03 | 2,60E-15 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 0,00E+00 | 1,21E-15 | 4,10E-02 | 3,30E-14 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 0,00E+00 | 3,81E-16 | 8,98E-03 | 6,76E-15 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC032 | Best | f | -3,07E+04 | -3,07E+04 | -2,99E+04 | -3,07E+04 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Median | | f | -3,07E+04 | -3,07E+04 | -2,95E+04 | -3,07E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Mean | | f | -3,07E+04 | -3,07E+04 | -2,94E+04 | -3,07E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Worst | | f | -3,07E+04 | -3,07E+04 | -2,79E+04 | -3,07E+04 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Std. dev. | | f | 3,71E-12 | 0,00E+00 | 4,63E+02 | 1,03E-07 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| RC033 | | Best | f | 2,64E+00 | 2,64E+00 | 4,99E+00 | 2,64E+00 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | 2,64E+00 | 2,64E+00 | 6,87E+00 | 2,64E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | 2,64E+00 | 2,64E+00 | 7,40E+00 | 2,64E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | 2,64E+00 | 2,64E+00 | 1,15E+01 | 2,64E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 1,02E-15 | 0,00E+00 | 1,69E+00 | 7,02E-16 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC034 | Best | f | 1,88E-08 | 4,32E+00 | 1,81E+01 | 1,26E+01 |
| | | | v | 1,49E-01 | 1,20E-03 | 4,01E-01 | 5,45E-01 |
| Median | | f | 1,85E+00 | 3,19E+00 | 6,69E+01 | 3,01E+01 | |
| | | v | 1,31E-01 | 4,48E-03 | 9,28E-01 | 7,46E-01 | |
| Mean | | f | 2,93E+00 | 4,95E+00 | 6,57E+01 | 2,96E+01 | |
| | | v | 1,20E-01 | 6,07E-03 | 9,46E-01 | 7,66E-01 | |
| Worst | | f | 1,15E+01 | 7,45E+00 | 8,82E+01 | 5,14E+01 | |
| | | v | 5,79E-02 | 1,88E-02 | 1,57E+00 | 1,17E+00 | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR |
|----------|-------------|----|-----------|--------------|-----------|-----------|
| | Std. dev. | f | 3,51E+00 | 2,02E+00 | 1,69E+01 | 9,59E+00 |
| | | v | 2,86E-02 | 4,82E-03 | 3,90E-01 | 1,43E-01 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [0 14 55] | [19 11 3] | [16 48 1] |
| RC035 | Best | f | -5,59E+01 | 1,01E+02 | 3,72E+02 | -1,25E+02 |
| | | v | 2,25E+00 | 3,82E-02 | 1,25E+01 | 4,18E+00 |
| | Median | f | 9,37E+01 | 1,11E+02 | 8,95E+02 | -1,70E+01 |
| | | v | 8,47E-01 | 1,03E-01 | 3,07E+01 | 8,21E+00 |
| | Mean | f | 7,32E+01 | 9,61E+01 | 9,45E+02 | 5,66E+01 |
| | | v | 1,27E+00 | 1,36E-01 | 3,22E+01 | 9,45E+00 |
| | Worst | f | 1,46E+02 | 9,89E+01 | 1,73E+03 | 5,74E+02 |
| | | v | 7,70E-01 | 4,66E-01 | 5,26E+01 | 2,34E+01 |
| | Std. dev. | f | 6,43E+01 | 2,13E+01 | 3,27E+02 | 1,78E+02 |
| | | v | 6,08E-01 | 9,34E-02 | 1,07E+01 | 4,87E+00 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [2 96 46] | [36 15 0] | [92 12 1] |
| RC036 | Best | f | -8,00E+01 | 1,16E+02 | 1,25E+02 | 1,33E+01 |
| | | v | 4,61E+00 | 3,61E-02 | 1,34E+01 | 4,09E+00 |
| | Median | f | 6,08E+01 | 8,86E+01 | 4,83E+02 | 1,33E+02 |
| | | v | 1,57E+00 | 1,35E-01 | 3,94E+01 | 1,16E+01 |
| | Mean | f | 4,88E+01 | 8,43E+01 | 5,67E+02 | 1,69E+02 |
| | | v | 2,29E+00 | 1,56E-01 | 3,71E+01 | 1,31E+01 |
| | Worst | f | 1,46E+02 | 8,41E+01 | 1,13E+03 | 4,44E+02 |
| | | v | 1,06E+00 | 3,84E-01 | 6,03E+01 | 2,72E+01 |
| | Std. dev. | f | 6,76E+01 | 1,94E+01 | 2,92E+02 | 1,18E+02 |
| | | v | 1,16E+00 | 9,87E-02 | 1,28E+01 | 6,49E+00 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [1 0 0] | [4 87 51] | [38 29 0] | [74 31 1] |
| RC037 | Best | f | -1,36E+01 | 2,71E+00 | -9,76E+00 | -3,22E+00 |
| | | v | 2,87E-01 | 8,94E-03 | 2,86E-01 | 4,00E-01 |
| | Median | f | 1,79E+00 | 2,54E+00 | 2,85E+00 | 5,01E+00 |
| | | v | 1,61E-01 | 1,51E-02 | 8,94E-01 | 7,50E-01 |
| | Mean | f | 1,14E+00 | 2,70E+00 | 2,50E+00 | 5,10E+00 |
| | | v | 1,30E-01 | 1,84E-02 | 9,91E-01 | 7,68E-01 |
| | Worst | f | 4,56E+00 | 4,32E+00 | 1,41E+01 | 2,11E+01 |
| | | v | 7,04E-02 | 3,60E-02 | 2,30E+00 | 1,55E+00 |
| | Std. dev. | f | 3,54E+00 | 7,92E-01 | 5,72E+00 | 5,74E+00 |
| | | v | 4,47E-02 | 8,79E-03 | 6,07E-01 | 2,77E-01 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [0 40 11] | [16 15 0] | [11 60 1] |
| RC038 | Best | f | -2,97E+00 | 1,01E+01 | 1,53E+01 | -1,89E+01 |
| | | v | 1,13E-01 | 7,88E-03 | 2,34E-01 | 4,28E-01 |
| | Median | f | 8,40E-01 | 8,87E+00 | 6,47E+01 | -3,36E+00 |
| | | v | 9,65E-02 | 1,39E-02 | 8,31E-01 | 5,98E-01 |
| | Mean | f | 1,06E+00 | 8,28E+00 | 6,18E+01 | -2,01E+00 |
| | | v | 1,02E-01 | 1,63E-02 | 9,44E-01 | 7,11E-01 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR |
|----------|-------------|----|-----------|--------------|-----------|-----------|
| | Worst | f | 5,73E+00 | 9,06E+00 | 9,28E+01 | 2,27E+01 |
| | | v | 7,48E-02 | 3,72E-02 | 2,86E+00 | 1,23E+00 |
| | Std. dev. | f | 1,83E+00 | 1,63E+00 | 1,76E+01 | 1,07E+01 |
| | | v | 1,68E-02 | 7,40E-03 | 6,46E-01 | 2,50E-01 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [0 35 21] | [25 24 0] | [20 46 1] |
| RC039 | Best | f | -7,73E+00 | 1,16E+01 | 4,22E+01 | -2,52E+01 |
| | | v | 1,43E-01 | 6,52E-03 | 2,32E-01 | 4,20E-01 |
| | Median | f | -7,36E-01 | 8,22E+00 | 9,17E+01 | -1,17E+01 |
| | | v | 1,20E-01 | 1,48E-02 | 7,50E-01 | 6,92E-01 |
| | Mean | f | -8,18E-01 | 9,31E+00 | 9,12E+01 | -1,03E+01 |
| | | v | 1,00E-01 | 1,66E-02 | 8,22E-01 | 7,09E-01 |
| | Worst | f | 3,05E+00 | 5,80E+00 | 1,18E+02 | 4,02E+00 |
| | | v | 6,56E-02 | 3,20E-02 | 1,61E+00 | 1,05E+00 |
| | Std. dev. | f | 2,37E+00 | 2,54E+00 | 1,96E+01 | 1,01E+01 |
| | | v | 1,62E-02 | 6,74E-03 | 4,04E-01 | 1,75E-01 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [0 42 32] | [7 4 0] | [24 50 3] |
| RC040 | Best | f | 8,77E+00 | 4,07E+01 | 5,18E+05 | 2,74E+04 |
| | | v | 1,01E+00 | 5,32E-01 | 2,27E+01 | 7,89E+00 |
| | Median | f | 2,40E+01 | 3,74E+01 | 2,74E+06 | 1,08E+05 |
| | | v | 1,20E+00 | 8,69E-01 | 6,14E+01 | 1,69E+01 |
| | Mean | f | 2,56E+01 | 1,12E+02 | 3,20E+06 | 3,37E+05 |
| | | v | 1,25E+00 | 9,20E-01 | 6,03E+01 | 2,38E+01 |
| | Worst | f | 5,13E+01 | 1,51E+02 | 6,57E+06 | 1,62E+06 |
| | | v | 1,38E+00 | 1,59E+00 | 1,04E+02 | 6,28E+01 |
| | Std. dev. | f | 1,09E+01 | 7,99E+01 | 1,67E+06 | 4,64E+05 |
| | | v | 3,17E-01 | 2,45E-01 | 2,12E+01 | 1,73E+01 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [1 0 0] | [11 26 32] | [32 1 0] | [47 0 0] |
| RC041 | Best | f | 3,39E-02 | 2,19E+00 | 1,47E+06 | 2,19E+04 |
| | | v | 1,73E-01 | 3,01E-01 | 3,66E+01 | 7,63E+00 |
| | Median | f | 2,98E+00 | 4,54E+01 | 2,49E+06 | 9,71E+04 |
| | | v | 4,73E-01 | 6,17E-01 | 5,94E+01 | 1,73E+01 |
| | Mean | f | 1,43E+03 | 1,83E+01 | 2,77E+06 | 1,75E+05 |
| | | v | 2,78E+00 | 6,39E-01 | 6,06E+01 | 2,05E+01 |
| | Worst | f | 2,93E+04 | 5,29E+01 | 1,01E+07 | 6,57E+05 |
| | | v | 9,33E+00 | 1,17E+00 | 1,25E+02 | 3,86E+01 |
| | Std. dev. | f | 5,85E+03 | 1,50E+01 | 1,69E+06 | 1,76E+05 |
| | | v | 3,45E+00 | 1,82E-01 | 1,82E+01 | 9,33E+00 |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | | C | [0 1 0] | [13 21 33] | [33 0 0] | [36 0 0] |
| RC042 | Best | f | -1,09E+01 | -1,66E+00 | -1,43E+03 | -6,56E+02 |
| | | v | 2,47E+00 | 7,02E-01 | 2,01E+01 | 5,70E+00 |
| | Median | f | -1,23E+00 | -1,61E+00 | -7,77E+02 | -1,15E+02 |
| | | v | 1,39E+00 | 1,03E+00 | 5,59E+01 | 1,26E+01 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|-----------|--------------|-----------|-----------|-----------|
| | Mean | f | -2,17E+00 | -2,61E+00 | -8,09E+02 | -1,52E+02 | |
| | | v | 2,20E+00 | 1,03E+00 | 5,77E+01 | 1,71E+01 | |
| | Worst | f | -8,24E-01 | -1,02E+00 | -4,78E+01 | -3,32E+00 | |
| | | v | 2,33E+00 | 1,44E+00 | 1,05E+02 | 6,83E+01 | |
| | Std. dev. | f | 2,23E+00 | 2,22E+00 | 3,66E+02 | 1,87E+02 | |
| | | v | 5,30E-01 | 2,09E-01 | 2,29E+01 | 1,47E+01 | |
| | Violation | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | | C | [1 0 0] | [11 30 28] | [30 4 0] | [39 1 0] | |
| | RC043 | Best | f | -1,89E+02 | 1,55E+01 | -8,62E+02 | -4,73E+02 |
| | | | v | 5,17E+00 | 7,06E-01 | 2,04E+01 | 4,13E+00 |
| Median | | f | 1,46E+01 | 1,98E+01 | -5,06E+02 | -7,29E+01 | |
| | | v | 1,32E+00 | 1,07E+00 | 5,02E+01 | 1,25E+01 | |
| Mean | | f | -1,39E+00 | 2,40E+01 | -5,17E+02 | -1,02E+02 | |
| | | v | 2,55E+00 | 1,04E+00 | 5,27E+01 | 1,60E+01 | |
| Worst | | f | 3,97E+01 | 2,00E+01 | 4,16E+01 | -4,58E+00 | |
| | | v | 2,28E+00 | 1,34E+00 | 9,16E+01 | 5,35E+01 | |
| Std. dev. | | f | 5,00E+01 | 5,49E+00 | 2,71E+02 | 1,03E+02 | |
| | | v | 8,90E-01 | 1,45E-01 | 1,79E+01 | 1,15E+01 | |
| Violation | | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | | C | [1 0 0] | [14 29 20] | [26 6 0] | [36 0 0] | |
| RC044 | | Best | f | -6,19E+03 | -6,20E+03 | -5,58E+03 | -5,75E+03 |
| | | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | Median | f | -6,08E+03 | -5,98E+03 | -5,24E+03 | -5,56E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Mean | f | -6,08E+03 | -6,03E+03 | -5,14E+03 | -5,56E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Worst | f | -6,00E+03 | -5,89E+03 | -4,66E+03 | -5,32E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Std. dev. | f | 5,35E+01 | 1,06E+02 | 2,65E+02 | 1,09E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 1,00E+02 | 1,00E+02 | |
| | | C | [000] | [000] | [000] | [000] | |
| | RC045 | Best | f | 7,43E-02 | 3,44E-02 | 1,33E+00 | 4,45E-01 |
| | | | v | 0,00E+00 | 0,00E+00 | 4,38E+00 | 0,00E+00 |
| Median | | f | 1,37E-01 | 4,14E-02 | 3,14E+00 | 9,27E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,04E+00 | 3,48E-01 | |
| Mean | | f | 1,43E-01 | 4,28E-02 | 3,33E+00 | 9,64E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,01E+00 | 7,39E-01 | |
| Worst | | f | 3,01E-01 | 5,49E-02 | 6,11E+00 | 1,48E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,00E+01 | 2,96E+00 | |
| Std. dev. | | f | 5,43E-02 | 5,52E-03 | 1,52E+00 | 2,77E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,51E+00 | 8,97E-01 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 2,00E-01 | |
| | | C | [000] | [000] | [14 1 0] | [13 4 0] | |
| RC046 | | Best | f | 5,15E-02 | 2,02E-02 | 3,65E-01 | 2,77E-01 |
| | | | v | 0,00E+00 | 0,00E+00 | 4,91E+00 | 0,00E+00 |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| | Median | f | 6,33E-02 | 2,48E-02 | 1,28E+00 | 5,72E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,62E+00 | 3,14E-01 | |
| | Mean | f | 6,36E-02 | 2,61E-02 | 1,46E+00 | 6,25E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,74E+00 | 6,78E-01 | |
| | Worst | f | 7,44E-02 | 4,05E-02 | 3,17E+00 | 1,17E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,07E+01 | 2,55E+00 | |
| | Std. dev. | f | 5,18E-03 | 5,68E-03 | 7,67E-01 | 2,68E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,56E+00 | 8,09E-01 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,60E-01 | |
| | | C | [000] | [000] | [12 1 0] | [0 4 1] | |
| | RC047 | Best | f | 3,82E-02 | 1,28E-02 | 3,73E-01 | 2,49E-01 |
| | | | v | 0,00E+00 | 0,00E+00 | 4,98E+00 | 0,00E+00 |
| Median | | f | 6,77E-02 | 1,89E-02 | 7,86E-01 | 5,31E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,02E+00 | 7,12E-01 | |
| Mean | | f | 6,44E-02 | 1,82E-02 | 8,98E-01 | 6,16E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,01E+00 | 8,63E-01 | |
| Worst | | f | 9,83E-02 | 2,59E-02 | 2,04E+00 | 1,49E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 8,96E+00 | 3,28E+00 | |
| Std. dev. | | f | 1,69E-02 | 3,20E-03 | 4,37E-01 | 3,11E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,05E+00 | 8,44E-01 | |
| Violation | | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 1,20E-01 | |
| | | C | [000] | [000] | [11 2 0] | [16 4 0] | |
| RC048 | Best | f | 4,04E-02 | 1,68E-02 | 1,42E-01 | 2,34E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,97E+00 | 1,07E-03 | |
| | Median | f | 4,77E-02 | 2,11E-02 | 7,10E-01 | 5,91E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,62E+00 | 1,93E+00 | |
| | Mean | f | 7,01E-02 | 2,19E-02 | 7,55E-01 | 7,33E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,91E+00 | 1,85E+00 | |
| | Worst | f | 5,50E-01 | 3,14E-02 | 1,55E+00 | 1,64E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,16E+01 | 3,86E+00 | |
| | Std. dev. | f | 1,00E-01 | 4,00E-03 | 3,54E-01 | 4,13E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,53E+00 | 1,01E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 0,00E+00 | |
| | | C | [000] | [000] | [16 0 0] | [16 3 0] | |
| RC049 | Best | f | 3,73E-02 | 2,17E-02 | 1,93E-01 | 1,70E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 4,73E+00 | 2,44E-04 | |
| | Median | f | 9,88E-02 | 3,24E-02 | 6,87E-01 | 3,61E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 6,82E+00 | 1,79E+00 | |
| | Mean | f | 9,42E-02 | 3,26E-02 | 7,05E-01 | 4,41E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 7,28E+00 | 1,82E+00 | |
| | Worst | f | 2,00E-01 | 4,00E-02 | 1,41E+00 | 1,08E+00 | |
| | | v | 0,00E+00 | 0,00E+00 | 9,68E+00 | 4,20E+00 | |
| | Std. dev. | f | 4,81E-02 | 4,07E-03 | 3,46E-01 | 2,52E-01 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,40E+00 | 1,27E+00 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 0,00E+00 | |
| | | C | [000] | [000] | [16 0 0] | [0 14 0] | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| RC050 | Best | f | 1,37E-01 | 2,05E-02 | 1,22E-01 | 1,16E-01 | |
| | | v | 2,07E-02 | 0,00E+00 | 5,00E+00 | 1,79E-02 | |
| | Median | f | 3,56E-01 | 3,95E-02 | 5,47E-01 | 4,48E-01 | |
| | | v | 1,29E-03 | 0,00E+00 | 7,73E+00 | 1,74E+00 | |
| | Mean | f | 3,27E-01 | 6,51E-02 | 5,72E-01 | 5,17E-01 | |
| | | v | 1,07E-02 | 4,02E-05 | 7,74E+00 | 1,75E+00 | |
| | Worst | f | 4,09E-01 | 1,10E-01 | 1,21E+00 | 1,01E+00 | |
| | | v | 1,59E-02 | 1,00E-03 | 1,07E+01 | 3,52E+00 | |
| | Std. dev. | f | 7,08E-02 | 4,82E-02 | 2,89E-01 | 2,38E-01 | |
| | | v | 4,06E-03 | 1,97E-04 | 1,40E+00 | 9,95E-01 | |
| | Violation | FR | 0,00E+00 | 9,60E+01 | 0,00E+00 | 0,00E+00 | |
| | | C | [0 0 1] | [000] | [15 2 0] | [12 4 0] | |
| | RC051 | Best | f | 4,46E+03 | 4,55E+03 | 6,91E+04 | 4,08E+03 |
| | | | v | 1,08E-03 | 2,82E-06 | 2,12E+01 | 0,00E+00 |
| Median | | f | 4,50E+03 | 4,55E+03 | 8,62E+04 | 4,54E+03 | |
| | | v | 3,89E-04 | 2,82E-06 | 2,56E+01 | 6,97E-04 | |
| Mean | | f | 4,50E+03 | 4,55E+03 | 8,47E+04 | 4,50E+03 | |
| | | v | 3,47E-04 | 2,82E-06 | 2,54E+01 | 2,01E-02 | |
| Worst | | f | 4,55E+03 | 4,55E+03 | 9,60E+04 | 4,75E+03 | |
| | | v | 4,03E-05 | 2,83E-06 | 2,79E+01 | 3,06E-01 | |
| Std. dev. | | f | 1,82E+01 | 6,78E-02 | 6,04E+03 | 1,51E+02 | |
| | | v | 1,91E-04 | 2,05E-09 | 1,63E+00 | 6,18E-02 | |
| Violation | | FR | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,00E-02 | |
| | | C | [0 0 1] | [0 0 1] | [5 1 1] | [0 0 6] | |
| RC052 | | Best | f | 3,35E+03 | 3,35E+03 | 6,95E+04 | 4,56E+03 |
| | | | v | 0,00E+00 | 0,00E+00 | 1,96E+01 | 0,00E+00 |
| | Median | f | 3,36E+03 | 3,37E+03 | 8,25E+04 | 5,53E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,51E+01 | 0,00E+00 | |
| | Mean | f | 3,37E+03 | 3,37E+03 | 8,29E+04 | 5,56E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,46E+01 | 1,49E-02 | |
| | Worst | f | 3,40E+03 | 3,40E+03 | 9,92E+04 | 6,53E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,86E+01 | 9,01E-02 | |
| | Std. dev. | f | 1,52E+01 | 1,30E+01 | 7,63E+03 | 4,91E+02 | |
| | | v | 0,00E+00 | 0,00E+00 | 1,99E+00 | 2,69E-02 | |
| | Violation | FR | 1,00E+02 | 1,00E+02 | 0,00E+00 | 7,20E-01 | |
| | | C | [000] | [000] | [6 1 0] | [000] | |
| | RC053 | Best | f | 4,35E+03 | 5,03E+03 | 6,88E+04 | 5,32E+03 |
| | | | v | 4,56E-03 | 0,00E+00 | 2,09E+01 | 0,00E+00 |
| Median | | f | 4,36E+03 | 5,09E+03 | 8,55E+04 | 5,58E+03 | |
| | | v | 5,28E-04 | 0,00E+00 | 2,54E+01 | 2,93E-04 | |
| Mean | | f | 4,68E+03 | 5,11E+03 | 8,54E+04 | 5,65E+03 | |
| | | v | 2,83E-03 | 0,00E+00 | 2,53E+01 | 1,04E-03 | |
| Worst | | f | 5,65E+03 | 5,24E+03 | 9,79E+04 | 6,09E+03 | |
| | | v | 0,00E+00 | 0,00E+00 | 2,81E+01 | 4,54E-03 | |
| Std. dev. | | f | 4,32E+02 | 5,65E+01 | 7,03E+03 | 1,81E+02 | |
| | | v | 1,99E-03 | 0,00E+00 | 1,43E+00 | 1,33E-03 | |

| Problems | Algorithm → | | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|-----------|-------------|------|----------|--------------|----------|----------|----------|
| | Violation | FR | 1,20E-01 | 1,00E+02 | 0,00E+00 | 2,40E-01 | |
| | | C | [0 0 1] | [000] | [5 2 0] | [0 0 5] | |
| RC054 | Best | f | 3,19E+03 | 4,24E+03 | 7,58E+04 | 3,30E+03 | |
| | | v | 4,08E-03 | 0,00E+00 | 2,31E+01 | 0,00E+00 | |
| | Median | f | 3,34E+03 | 4,25E+03 | 8,62E+04 | 4,27E+03 | |
| | | v | 1,35E-03 | 0,00E+00 | 2,65E+01 | 0,00E+00 | |
| | Mean | f | 3,33E+03 | 4,25E+03 | 8,63E+04 | 4,23E+03 | |
| | | v | 1,48E-03 | 0,00E+00 | 2,61E+01 | 4,42E-04 | |
| | Worst | f | 3,34E+03 | 4,25E+03 | 9,71E+04 | 4,27E+03 | |
| | | v | 1,35E-03 | 0,00E+00 | 2,86E+01 | 1,11E-02 | |
| | Std. dev. | f | 3,01E+01 | 3,41E+00 | 5,91E+03 | 1,93E+02 | |
| | | v | 5,48E-04 | 0,00E+00 | 1,42E+00 | 2,21E-03 | |
| | Violation | FR | 0,00E+00 | 1,00E+02 | 0,00E+00 | 9,60E-01 | |
| | | C | [0 0 1] | [000] | [6 0 0] | [000] | |
| | RC055 | Best | f | 1,69E+03 | 6,70E+03 | 8,03E+04 | 5,99E+03 |
| | | | v | 9,79E-03 | 0,00E+00 | 7,45E+01 | 2,00E-03 |
| Median | | f | 5,69E+03 | 6,71E+03 | 1,00E+05 | 6,75E+03 | |
| | | v | 9,14E-03 | 0,00E+00 | 8,27E+01 | 3,26E-03 | |
| Mean | | f | 4,94E+03 | 6,73E+03 | 9,88E+04 | 7,14E+03 | |
| | | v | 3,20E-03 | 1,81E-05 | 8,24E+01 | 3,38E-03 | |
| Worst | | f | 6,71E+03 | 6,92E+03 | 1,22E+05 | 1,19E+04 | |
| | | v | 0,00E+00 | 1,68E-04 | 8,95E+01 | 6,60E-03 | |
| Std. dev. | | f | 1,69E+03 | 5,47E+01 | 9,49E+03 | 1,31E+03 | |
| | | v | 3,44E-03 | 4,71E-05 | 4,39E+00 | 1,02E-03 | |
| Violation | | FR | 4,00E-02 | 8,40E+01 | 0,00E+00 | 0,00E+00 | |
| | | C | [0 0 1] | [000] | [6 0 0] | [0 0 4] | |
| RC056 | | Best | f | 9,05E+03 | 1,48E+04 | 8,62E+04 | 1,24E+04 |
| | | | v | 1,06E-02 | 0,00E+00 | 7,11E+01 | 4,10E-03 |
| | Median | f | 1,20E+04 | 1,48E+04 | 9,93E+04 | 1,43E+04 | |
| | | v | 7,79E-03 | 7,07E-05 | 7,85E+01 | 6,00E-03 | |
| | Mean | f | 1,14E+04 | 1,46E+04 | 1,00E+05 | 1,45E+04 | |
| | | v | 5,86E-03 | 1,52E-04 | 7,80E+01 | 6,17E-03 | |
| | Worst | f | 1,30E+04 | 1,40E+04 | 1,16E+05 | 1,82E+04 | |
| | | v | 2,69E-03 | 6,25E-04 | 8,47E+01 | 9,63E-03 | |
| | Std. dev. | f | 1,22E+03 | 2,05E+02 | 8,02E+03 | 1,36E+03 | |
| | | v | 2,75E-03 | 1,90E-04 | 3,41E+00 | 1,25E-03 | |
| | Violation | FR | 0,00E+00 | 4,80E+01 | 0,00E+00 | 0,00E+00 | |
| | | C | [0 0 1] | [0 0 2] | [6 0 0] | [0 2 1] | |
| | RC057 | Best | f | 1,96E+03 | 3,30E+03 | 8,54E+04 | 2,66E+03 |
| | | | v | 1,96E-03 | 0,00E+00 | 7,48E+01 | 1,35E-03 |
| Median | | f | 2,47E+03 | 3,51E+03 | 1,02E+05 | 3,25E+03 | |
| | | v | 4,91E-04 | 0,00E+00 | 8,44E+01 | 3,45E-03 | |
| Mean | | f | 2,47E+03 | 3,63E+03 | 1,02E+05 | 6,24E+03 | |
| | | v | 1,03E-03 | 0,00E+00 | 8,38E+01 | 3,35E-03 | |
| Worst | | f | 3,54E+03 | 4,53E+03 | 1,16E+05 | 1,31E+04 | |
| | | v | 6,46E-05 | 0,00E+00 | 8,98E+01 | 6,52E-03 | |

| Problems | Algorithm → | MODE [1] | COLSHADE [2] | WSA [3] | WSAR | |
|----------|-------------|----------|--------------|----------|----------|----------|
| | Std. dev. | f | 3,74E+02 | 2,93E+02 | 7,88E+03 | 3,77E+03 |
| | | v | 5,42E-04 | 0,00E+00 | 3,92E+00 | 1,39E-03 |
| | Violation | FR | 0,00E+00 | 1,00E+02 | 0,00E+00 | 0,00E+00 |
| | | C | [0 0 1] | [000] | [6 0 0] | [0 0 3] |

- [1] K. M. Sallam, S. M. Elsayed, R. K. Chakraborty, M. J. Ryan, Multi-operator differential evolution algorithm for solving real-world constrained optimization problems, IEEE Congress on Evolutionary Computation, Glasgow, UK, 2020.
- [2] J. Gurrola-Ramos, A. Hernández-Aguirre, O. Dalmau-Cedeño, COLSHADE for real-world single-objective constrained optimization problems, IEEE Congress on Evolutionary Computation, Glasgow, UK, 2020.
- [3] A. Baykasoğlu, S. Akpınar, Enhanced superposition determination for weighted superposition attraction algorithm, *Soft. Comput.* 24(2020) 15015–15040.