

CEC 2020 Benchmark Functions

baseCSA and modifiedCSA comparison with seven other Meta-Heuristic Algorithms

| Function | BestAlgorithm | BaseCSA_Mean | ModCSA_Mean | ABC_Mean | DE_Mean | GA_custom_Mean | GWO_Mean | PSO_Mean | SSA_Mean | WOA_Mean |
|----------|---------------|--------------|-------------|-------------|-------------|----------------|-------------|-------------|-------------|-------------|
| F1 | DE | 70097760843 | 1.10908E+11 | 43336.14027 | 100 | 2906.8374 | 920395851.1 | 7912691129 | 1062.570927 | 48624530826 |
| F2 | GWO | 8639.408539 | 8463.837429 | 9798.465822 | 7877.569434 | 5655.115027 | 3682.195743 | 5684.843685 | 4369.51256 | 6694.708398 |
| F3 | GWO | 2319.773426 | 2319.497006 | 1065.533816 | 897.0550771 | 1198.842236 | 844.0040108 | 861.9227936 | 924.4137331 | 1324.910791 |
| F4 | GWO | 244024.2275 | 227929.7815 | 2426.665453 | 1913.982175 | 1900.41431 | 1900 | 1909.876125 | 1916.68294 | 1900 |
| F5 | DE | 51575939.57 | 29834124.19 | 9991015.476 | 2100.611757 | 2876718.183 | 954597.7354 | 29103905.6 | 136888.9599 | 124754591.8 |
| F6 | GWO | 4154.854351 | 4711.835291 | 3538.439668 | 2110.036932 | 2964.11378 | 2030.968926 | 3569.91461 | 2629.344107 | 3708.291518 |
| F7 | DE | 23884890.39 | 25232280.42 | 6238765.236 | 2336.761369 | 2344585.87 | 1805246.508 | 153593.9792 | 69014.50325 | 54635476.92 |
| F8 | DE | 5.12902E+11 | 1.04398E+11 | 2.22669E+13 | 2363.756019 | 30905056643 | 412458.5036 | 2398.751302 | 2389.076902 | 7254626991 |

baseCSA and modifiedCSA comparison with other CSA Variants

| Function | BestAlgorithm | BaseCSA_Mean | ModCSA_Mean | CSA_ADAPTIVE_Mean | CSA_CHAOTIC_Mean | CSA_LF_Mean | CSA_OB_Mean | CSA_PSO_Mean |
|----------|---------------|--------------|-------------|-------------------|------------------|-------------|-------------|--------------|
| F1 | CSA_CHAOTIC | 96943255138 | 71336428186 | 17210.51965 | 2782.029753 | 8586.752907 | 10202902.86 | 45643279529 |
| F2 | CSA_LF | 8600.413572 | 8915.285402 | 5513.425103 | 5679.112974 | 4953.397084 | 5386.161229 | 7679.647451 |
| F3 | CSA_OB | 2137.746669 | 2532.233239 | 2830.440687 | 2750.168551 | 1499.13393 | 1124.819066 | 2756.511259 |
| F4 | CSA_OB | 166651.7389 | 103678.0025 | 2172.385599 | 1923.549351 | 1921.597182 | 1914.321478 | 788463.1393 |
| F5 | CSA_OB | 27546619.9 | 87592414.33 | 197460.0928 | 188844.8716 | 744864.7967 | 150589.5367 | 29522499.28 |
| F6 | CSA_CHAOTIC | 4437.159052 | 5050.293556 | 3783.790077 | 3119.991645 | 3907.188885 | 3189.239879 | 4043.909139 |
| F7 | CSA_CHAOTIC | 15269812.85 | 11419190.52 | 130377.201 | 28306.38516 | 86521.16792 | 70315.29517 | 8031929.955 |
| F8 | BaseCSA | NaN | NaN | NaN | NaN | NaN | NaN | NaN |