

Supplementary Material - Correlation-based Analysis of the Influence of Bound Constraint Handling Methods on Population Dynamics in Differential Evolution

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1 SUMMARY OF RESULTS

Tables 1 - 5 present a summary of the values achieved in the final iteration using LSHADE in combination with the following correction methods: 'sat', 'midT', 'midB', 'unif', 'beta', 'mir', 'tor', 'expC_R', 'expC_T', 'expC_B', 'vectR', 'vectT', 'vectB', 'mahalanobis', as averaged values on 5 independent runs. The BCHMs were applied on BBOB functions f3, f4, f5, f16, f23, for instance 1.

f3	Last error	Last varpop	Last it
LSHADE_midT	4.22E-07	9.34E-11	622
LSHADE_midB	4.26E-07	9.27E-11	613
LSHADE_vectT	4.61E-07	9.17E-11	648
LSHADE_expC_B	4.88E-07	9.58E-11	614
LSHADE_mir	5.36E-07	9.87E-11	597
LSHADE_mahalanobis	5.52E-07	9.76E-11	605
LSHADE_beta	5.61E-07	9.13E-11	616
LSHADE_expC_R	5.93E-07	8.79E-11	617
LSHADE_sat	5.99E-07	9.66E-11	601
LSHADE_expC_T	6.48E-07	1.00E-10	610
LSHADE_vectR	6.76E-07	8.68E-11	607
LSHADE_unif	7.25E-07	9.25E-11	604
LSHADE_tor	7.71E-07	9.66E-11	621
LSHADE_vectB	0.99496	9.46E-11	556

Table 1. Average results on optimizing f3 from 5 independent runs of LSHADE coupled with different correction strategies, showing the final error value, final population variance, and the last iteration value (common maximum across runs).

2 EVOLUTION OF MEASURES DURING EVOLUTIONARY PROCESS

Figures presented in this section illustrate the evolution during the evolutive process for averaged values on 5 independent runs across common maximum iteration for measures: 'error', 'prob_infeas', 'genSuccessMutants', 'varPop', 'avgF', 'avgCR', 'extension', 'shape', 'eccentricity', 'kl_unif'

f4	Last error	Last varpop	Last it
LSHADE_tor	1.08E-06	9.46E-11	743
LSHADE_expC_R	1.12E-06	9.63E-11	703
LSHADE_midT	1.15E-06	9.72E-11	713
LSHADE_beta	1.24E-06	9.57E-11	690
LSHADE_expC_B	1.33E-06	9.13E-11	705
LSHADE_unif	1.34E-06	9.27E-11	701
LSHADE_vectR	1.34E-06	9.39E-11	730
LSHADE_midB	1.35E-06	9.38E-11	693
LSHADE_vectT	1.49E-06	9.26E-11	718
LSHADE_mir	1.67E-06	9.93E-11	682
LSHADE_expC_T	1.67E-06	9.08E-11	696
LSHADE_mahalanobis	1.68E-06	9.79E-11	731
LSHADE_sat	1.81E-06	9.11E-11	725
LSHADE_vectB	38.58175	8.65E-11	443

Table 2. Average results on optimizing f4 from 5 independent runs of LSHADE coupled with different correction strategies, showing the final error value, final population variance, and the last iteration value (common maximum across runs).

f5	Last error	Last varpop	Last it
LSHADE_vectT	1.55E-06	8.53E-11	382
LSHADE_sat	2.77E-05	7.57E-11	75
LSHADE_mahalanobis	5.19E-05	8.46E-11	76
LSHADE_expC_B	0.000106	9.01E-11	103
LSHADE_midB	0.000124	9.40E-11	95
LSHADE_expC_T	0.000207	9.30E-11	159
LSHADE_midT	0.000244	7.89E-11	149
LSHADE_tor	0.000252	7.21E-11	960
LSHADE_mir	0.000288	8.96E-11	216
LSHADE_unif	0.000343	8.68E-11	876
LSHADE_vectR	0.000393	9.97E-11	648
LSHADE_expC_R	0.000396	9.90E-11	771
LSHADE_beta	0.000445	9.33E-11	308
LSHADE_vectB	0.019977	4.63E-11	174

Table 3. Average results on optimizing f5 from 5 independent runs of LSHADE coupled with different correction strategies, showing the final error value, final population variance, and the last iteration value (common maximum across runs).

f16	Last error	Last varpop	Last it
LSHADE_vectB	3.762903	9.41E-11	220
LSHADE_sat	3.834762	8.906825	1023
LSHADE_midT	3.997328	6.489276	1023
LSHADE_midB	4.218521	5.913417	1023
LSHADE_vectR	4.251953	4.080579	1023
LSHADE_mahalanobis	4.27712	7.961117	1023
LSHADE_unif	4.335185	4.974819	1023
LSHADE_vectT	4.374532	6.376796	1023
LSHADE_mir	4.535486	6.63131	1023
LSHADE_tor	4.541576	6.412162	1023
LSHADE_expC_R	4.563945	7.567492	1023
LSHADE_beta	4.631935	5.546283	1023
LSHADE_expC_T	4.665361	8.027182	1023
LSHADE_expC_B	5.737287	7.161388	1023

Table 4. Average results on optimizing f16 from 5 independent runs of LSHADE coupled with different correction strategies, showing the final error value, final population variance, and the last iteration value (common maximum across runs).

f23	Last error	Last varpop	Last it
LSHADE_vectB	0.35126	9.80E-11	357
LSHADE_vectT	0.635142	6.028916	1023
LSHADE_vectR	0.746741	4.629488	1023
LSHADE_unif	0.766893	5.854326	1023
LSHADE_expC_T	0.793118	7.827037	1023
LSHADE_tor	0.801233	7.003262	1023
LSHADE_mir	0.807173	7.079231	1023
LSHADE_expC_B	0.836469	7.76098	1023
LSHADE_beta	0.841994	5.703216	1023
LSHADE_expC_R	0.891991	7.270259	1023
LSHADE_midT	0.917878	6.00459	1023
LSHADE_mahalanobis	1.055953	7.216888	1023
LSHADE_midB	1.150472	5.920429	1023
LSHADE_sat	1.424582	8.438949	1023

Table 5. Average results on optimizing f23 from 5 independent runs of LSHADE coupled with different correction strategies, showing the final error value, final population variance, and the last iteration value (common maximum across runs).

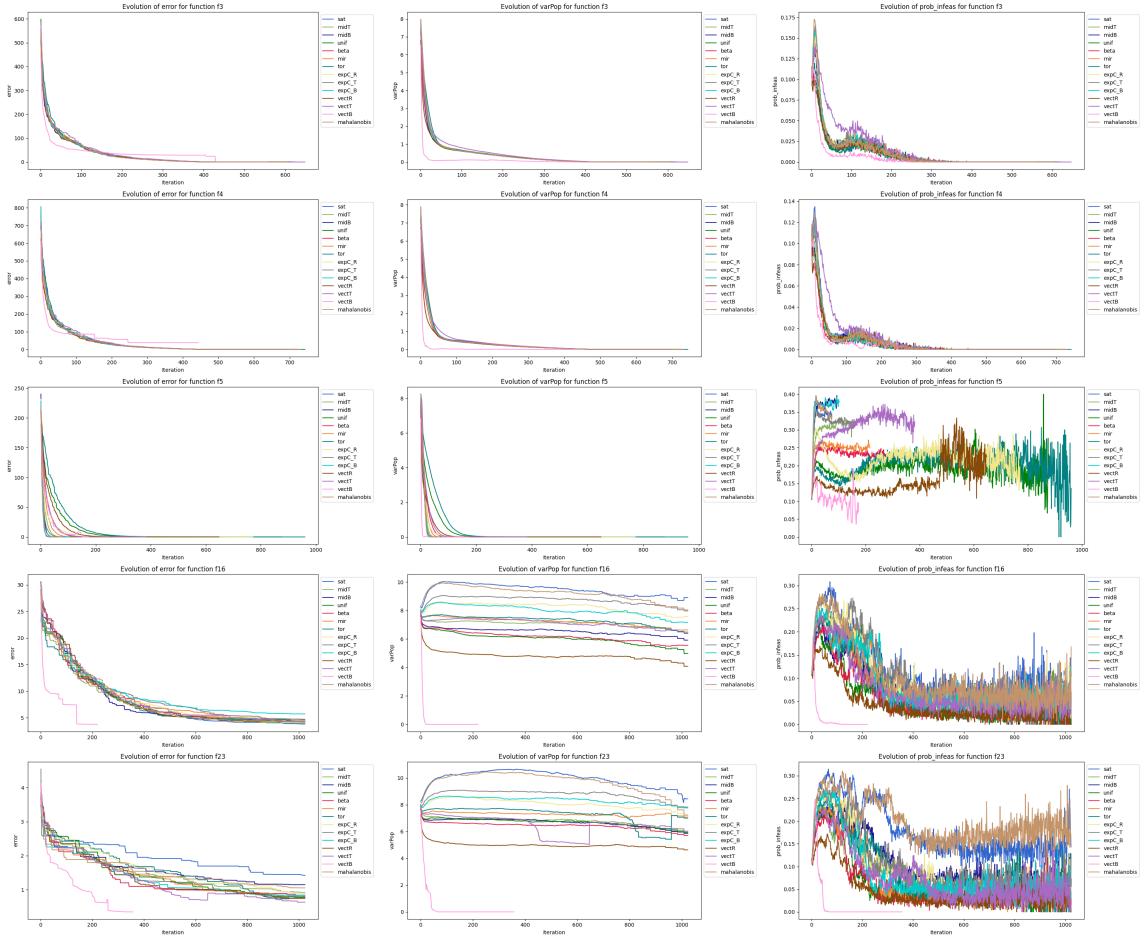


Fig. A. Comparison in error, varPop and prob_infeas evolution during iterations as averaged values on 5 independent runs for BBOB functions: 3, 4, 5, 16, 23, instance 1

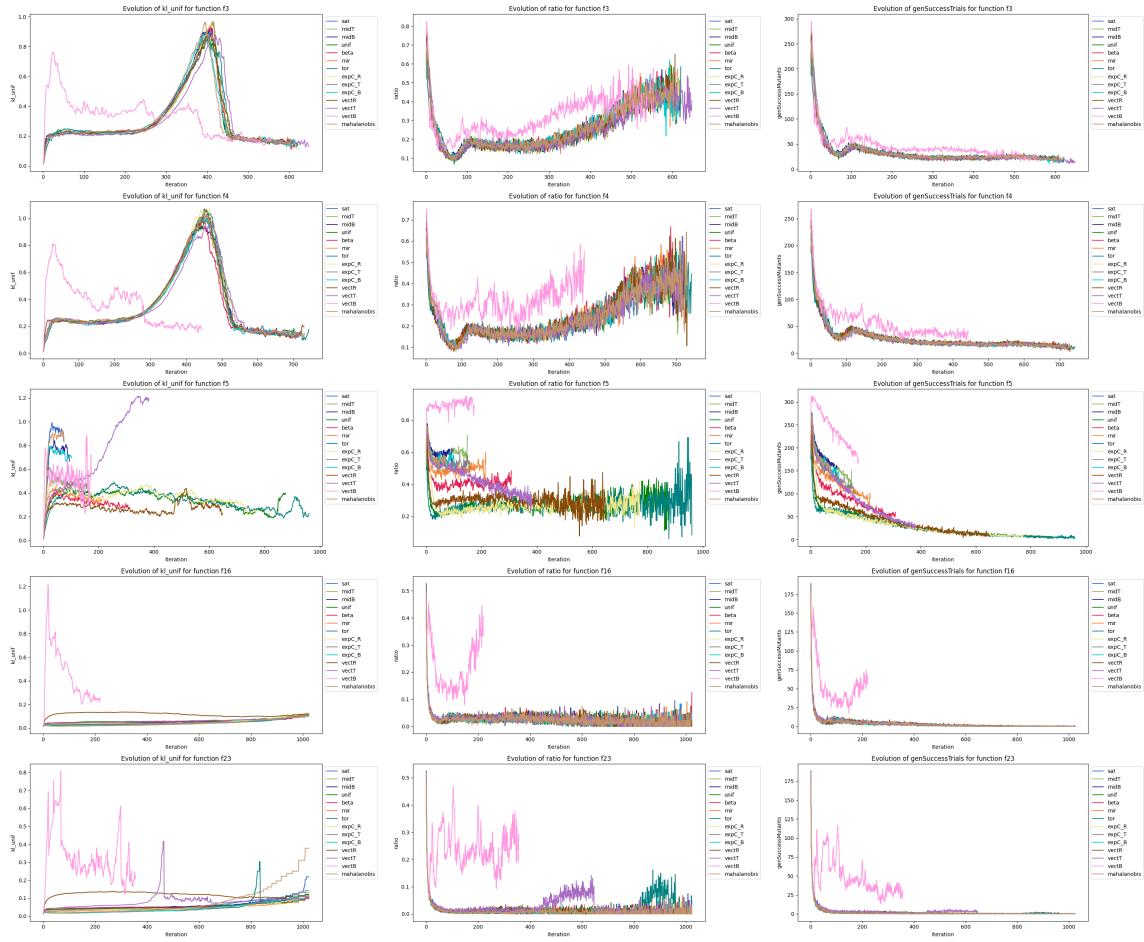


Fig. B. Comparison in k1_unif, ratio and genSuccessTrials evolution during iterations as averaged values on 5 independent runs for BBOB functions: 3, 4, 5, 16, 23, instance 1

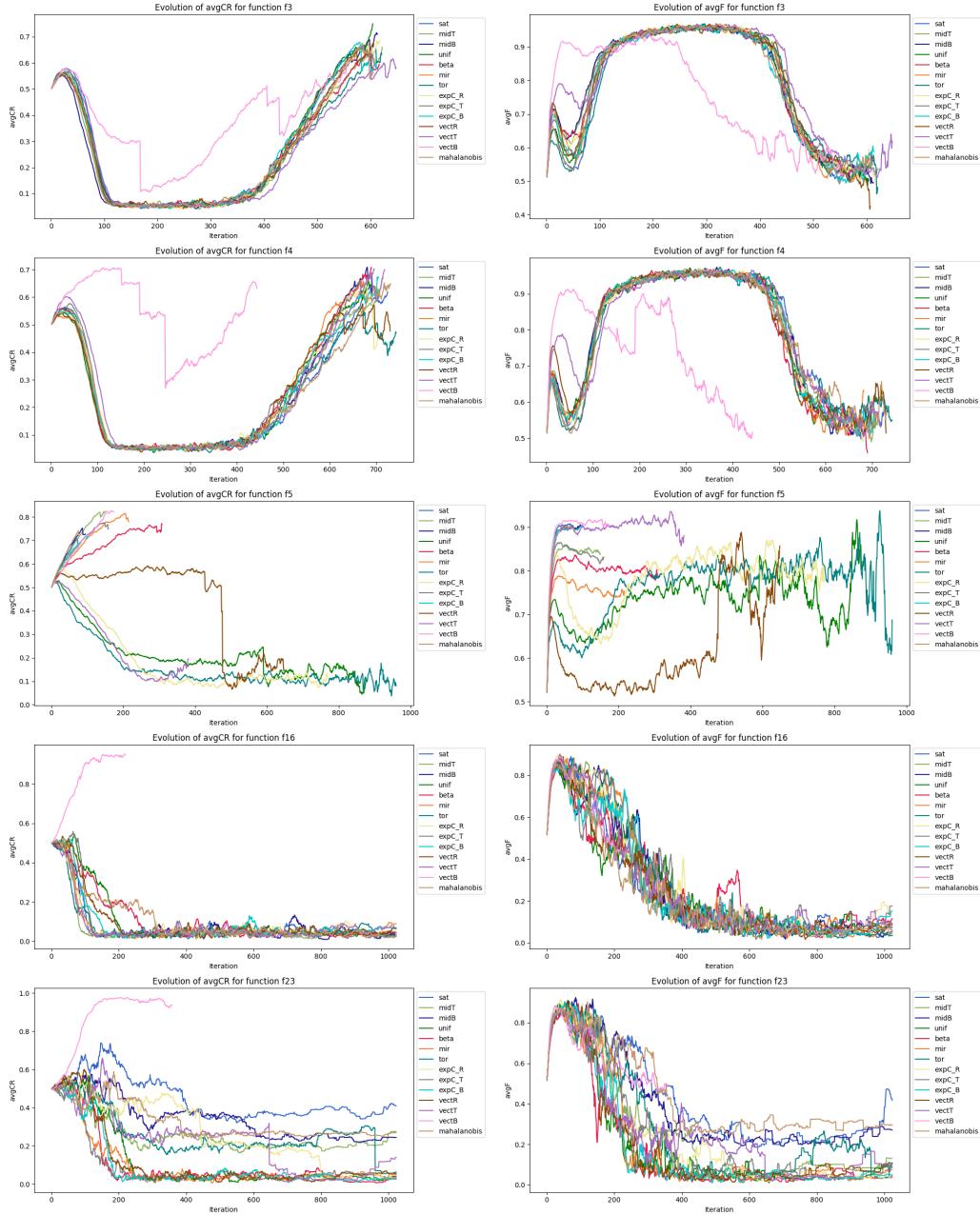


Fig. C. Comparison in avgCR and avgF volution during iterations as averaged values on 5 independent runs for BBOB functions: 3, 4, 5, 16, 23, instance 1

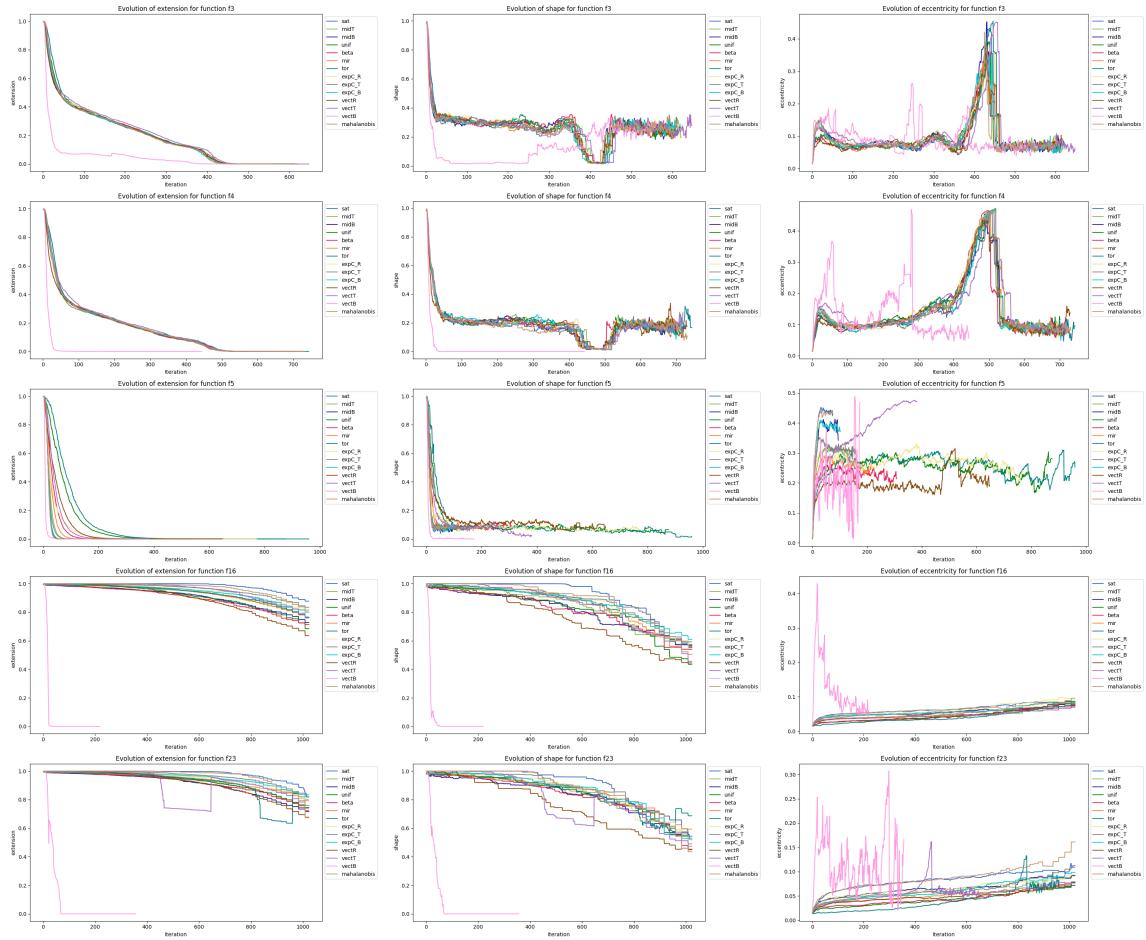


Fig. D. Comparison in extension, shape and eccentricity evolution during iterations as averaged values on 5 independent runs for BBOB functions: 3, 4, 5, 16, 23, instance 1