

Table 1: Performance Results for Zakharov_5D Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
QQN-StrongWolfe	2.41e-9	3.17e-9	2.91e-14	9.91e-9	100.3	100.0	0.003
QQN-Bisection-2	1.50e-9	1.97e-9	2.56e-15	6.16e-9	114.7	100.0	0.002
QQN-Bisection-1	1.12e-12	2.99e-12	5.59e-14	1.40e-11	118.0	100.0	0.002
QQN-GoldenSection	2.83e-12	2.87e-12	2.45e-13	1.21e-11	138.0	100.0	0.002
QQN-CubicQuadraticInterpolation	1.52e-9	1.59e-9	3.50e-12	5.23e-9	205.0	100.0	0.007
GD	9.78e-9	9.76e-11	9.63e-9	9.97e-9	477.1	100.0	0.013
L-BFGS-Conservative	7.32e-9	2.98e-9	2.42e-10	9.99e-9	492.9	100.0	0.012
L-BFGS-MoreThuente	9.32e-9	3.60e-10	8.60e-9	9.95e-9	634.6	100.0	0.013
L-BFGS-Limited	1.94e-8	4.45e-8	7.85e-9	2.13e-7	1078.6	95.0	0.016
Adam-WeightDecay	8.64e-3	1.13e-2	9.76e-9	2.86e-2	1586.3	60.0	0.036
GD-WeightDecay	7.62e-1	4.69e-1	9.24e-9	1.31e0	52.5	25.0	0.002
Adam	2.82e-3	2.38e-3	2.65e-4	7.47e-3	2502.0	0.0	0.054
Adam-AMSGrad	2.23e-2	1.32e-2	4.59e-3	5.39e-2	2502.0	0.0	0.059
Adam-Robust	7.06e-2	7.45e-2	6.18e-3	2.91e-1	2502.0	0.0	0.059
L-BFGS	2.69e1	2.46e1	2.58e-1	8.10e1	93.0	0.0	0.001
Trust Region-Aggressive	5.65e1	1.12e2	6.02e-1	4.25e2	2415.8	0.0	0.017
GD-Nesterov	5.05e0	2.73e0	1.42e0	1.10e1	18.1	0.0	0.001
Adam-Fast	9.66e0	1.31e0	7.78e0	1.15e1	34.8	0.0	0.001
L-BFGS-Aggressive	4.22e1	8.64e0	2.82e1	6.13e1	3309.5	0.0	0.062
GD-Momentum	5.45e1	1.33e1	3.48e1	9.04e1	18.9	0.0	0.001
GD-AdaptiveMomentum	6.97e1	1.64e1	4.83e1	1.09e2	18.5	0.0	0.001
Trust Region-Standard	2.28e3	8.27e2	6.92e2	3.84e3	3002.0	0.0	0.020
Trust Region-Adaptive	3.10e3	8.27e2	1.77e3	4.98e3	3002.0	0.0	0.021
Trust Region-Precise	3.50e3	7.96e2	2.04e3	4.73e3	3002.0	0.0	0.021
Trust Region-Conservative	3.28e3	6.15e2	2.05e3	4.46e3	3002.0	0.0	0.020