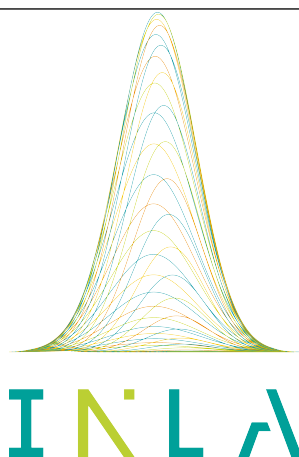


PHD REPORT - BAYESIAN STATISTICS



## A Smart Numerical Gradient

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February 14, 2021

Bayesian Computational Statistics and Modeling Research Group  
King Abdullah University of Science and Technology

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1	Test Some Functions
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# 1 Test Some Functions

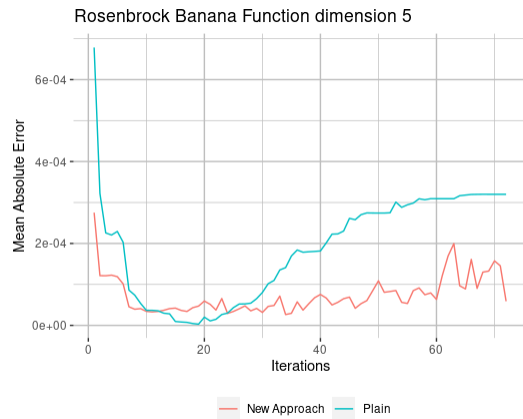


Figure 1: MSE of Rosenbrock Function (Dim 5)

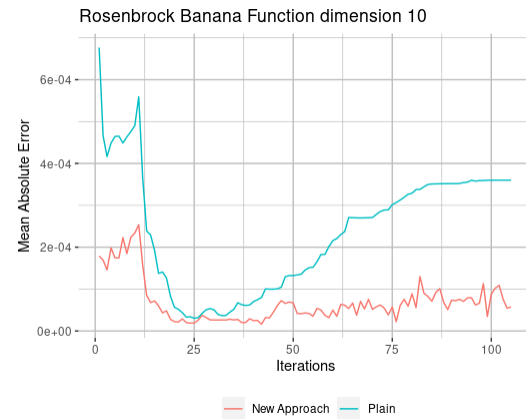


Figure 2: Rosenbrock Function (Dim 10)

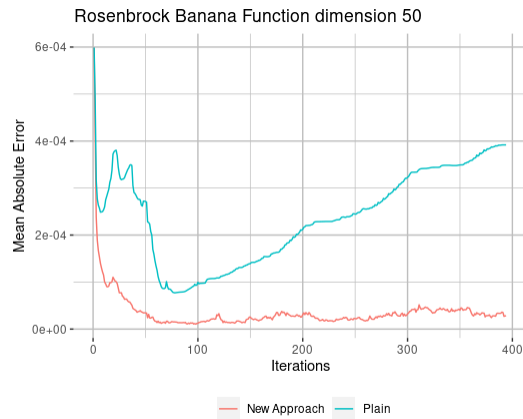


Figure 3: Rosenbrock Function (Dim 50)

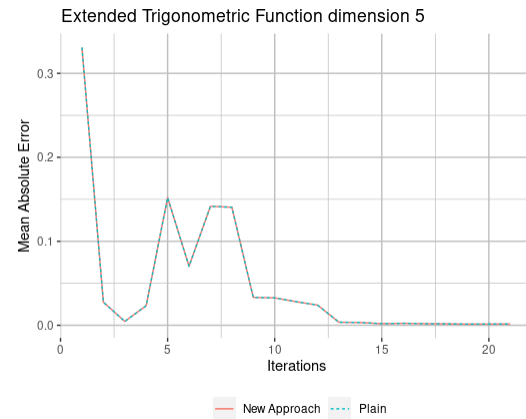


Figure 4: Ext. Trigonometric Function (Dim 5)

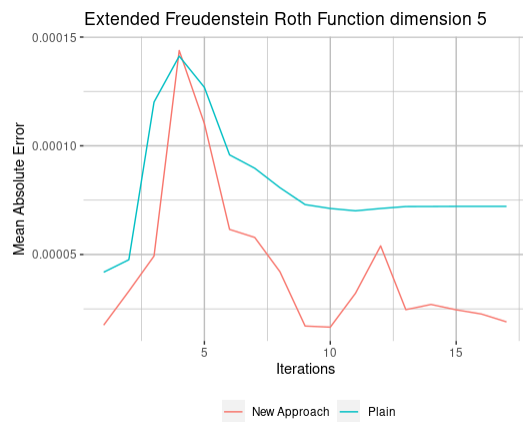


Figure 5: Ext. Freudenstein Roth Function (Dim 5)

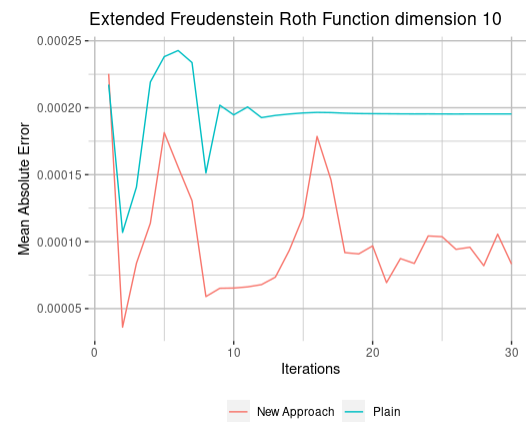


Figure 6: Ext. Freudenstein Roth Function (Dim 10)

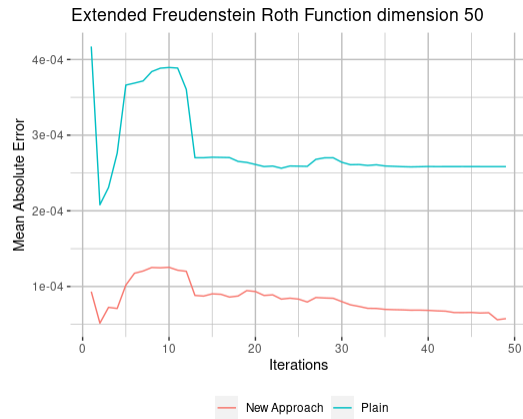


Figure 7: Ext. Freudenstein Roth Function (Dim 50)

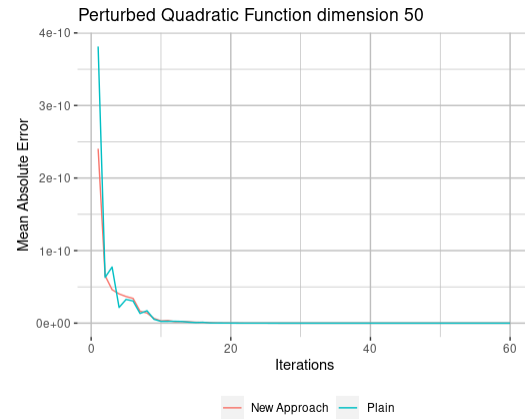


Figure 8: Perturbed Quadratic Function (Dim 50)

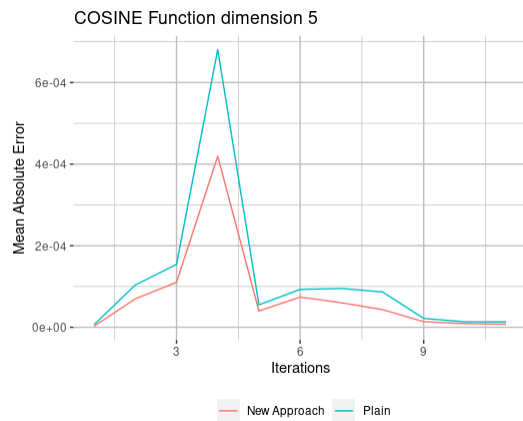


Figure 9: COSINE Function (Dim 50)

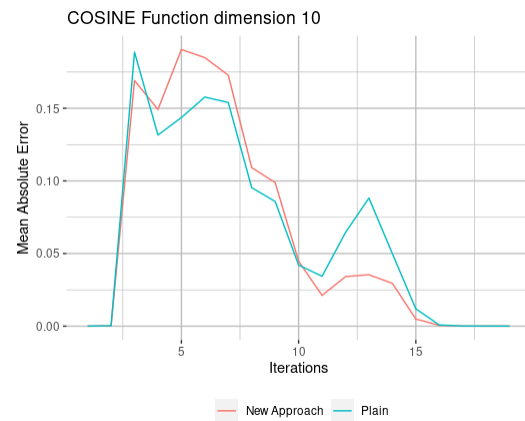


Figure 10: COSINE Function (Dim 10)

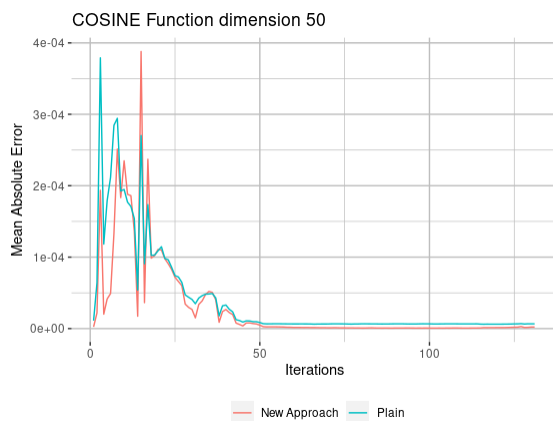


Figure 11: COSINE Function (Dim 50)

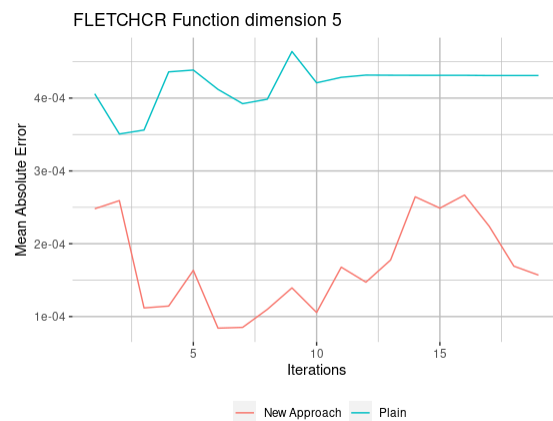


Figure 12: FLETCHCR Function (Dim 5)

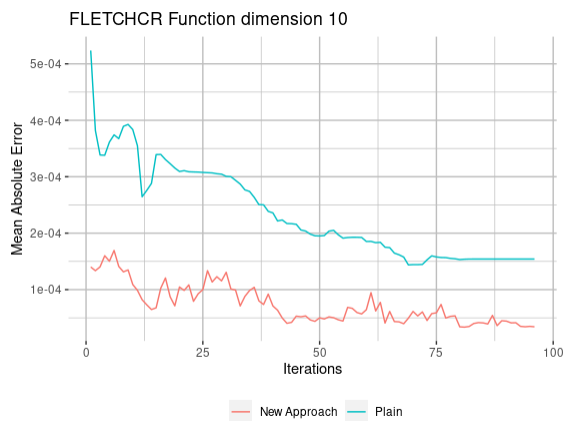


Figure 13: FLETCHCR Function (Dim 10)

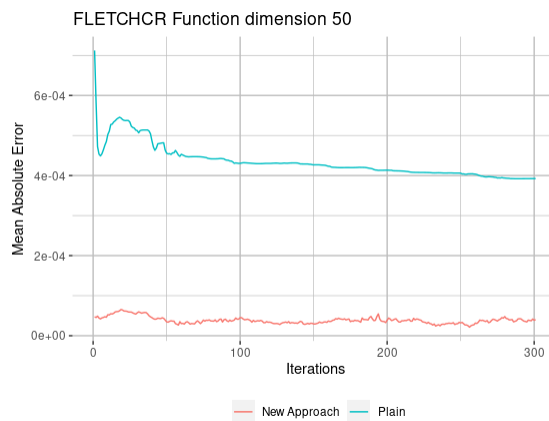


Figure 14: FLETCHCR Function (Dim 50)

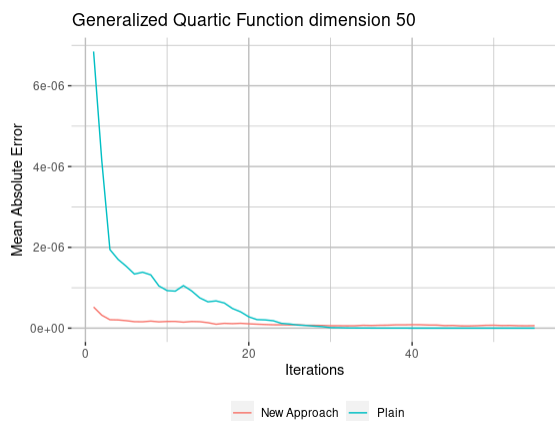


Figure 15: Generalized Quartic Function (Dim 50)

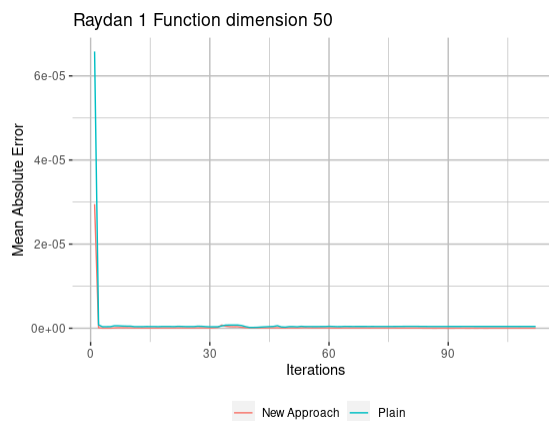


Figure 16: Raydan 1 Function (Dim 50)

Function	$x$ dimension	Average MSE 100 iterations Default Approach	Average MSE 100 iterations New Approach
Rosenbrock Banana Function	5	0.00026	0.000104
Rosenbrock Banana Function	10	0.000271	7.8e-05
Rosenbrock Banana Function	50	0.000292	7.8e-05
Rosenbrock Banana Function	100		
Extended Trigonometric Function	5	0.048934	0.048932
Extended Trigonometric Function	10		
Extended Freudenstein Roth Function	5	0.000226	0.000137
Extended Freudenstein Roth Function	10	0.000262	0.000132
Extended Freudenstein Roth Function	50	0.000299	0.000106
Perturbed Quadratic Function	50	0	0
COSINE Function	5	0.0123	0.007932
COSINE Function	10	1.199679	1.016674
COSINE Function	50	0.181691	0.142211
FLETCHCR Function	5	0.000318	0.000139
FLETCHCR Function	10	0.000327	0.000104
FLETCHCR Function	50	0.000361	4e-05
Generalized Quartic Function	50	1e-06	0
Raydan 1 Function	50	1e-06	0