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EVOLUTIONARY ALGORITHMS
PROJECT 1

Function Rosenbrock:

a=1,5 b=1,5

$$f(x)=(1-x-a)^2+100*(y-b-(x-a)^2)^2$$

Min(x,y)=(-0.5,5.5)

f(-0.5,5.5)=0

Summarize all results:

Algorithm	x	y	Nº f evaluations	Nº solver iterations	F min
fminsearch	1,753	2,056	185	88	0
	3,326	2,593	210	113	0
	2,764	3,415	214	115	0
	1,695	3,429	209	114	0
Fminc quasi newton	1,753	2,056	135	32	0
	3,326	2,593	171	48	0
	2,764	3,415	177	46	0
	1,695	3,429	189	38	0
Steepest descend	1,7539	2,0569	2331	201	0,6999
	3,3267	2,5937	2124	201	0,0003
	2,7647	3,4150	2550	201	0,1298
	1,6950	3,4297	2196	201	0,0004
Trust region	1,7539	2,0569	30	29	1,2832e-15
	3,3267	2,5937	35	34	7,3822e-11
	2,7647	3,4150	37	36	2,0515e-16
	1,6950	3,4297	38	37	8,2559e-15
Trust region with hessian	1,7539	2,0569	30	29	1,2832e-15
	3,3267	2,5937	35	34	7,3822e-11
	2,7647	3,4150	37	36	2,0515e-16
	1,6950	3,4297	38	37	8,2559e-15
Least	1,7539	2,0569	84	27	5,0109e-23

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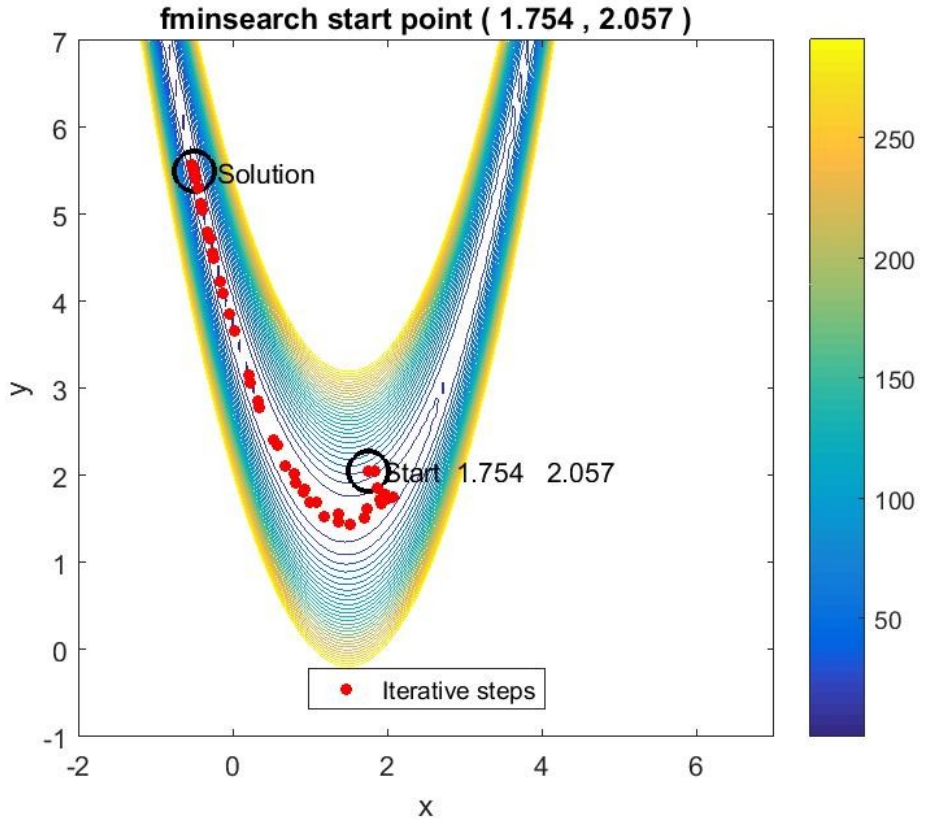
Square Error	3,3267	2,5937	75	24	3,0351e-20
	2,7647	3,4150	78	25	1,2106e-19
	1,6950	3,4297	81	26	2,3672e-21

Algorithm fminsearch

x	y	Nº f evaluations	Nº solver iterations	F min
1,753	2,056	185	88	0
3,326	2,593	210	113	0
2,764	3,415	214	115	0
1,695	3,429	209	114	0

(Script OptimfminseatchRosenbrock.mat)



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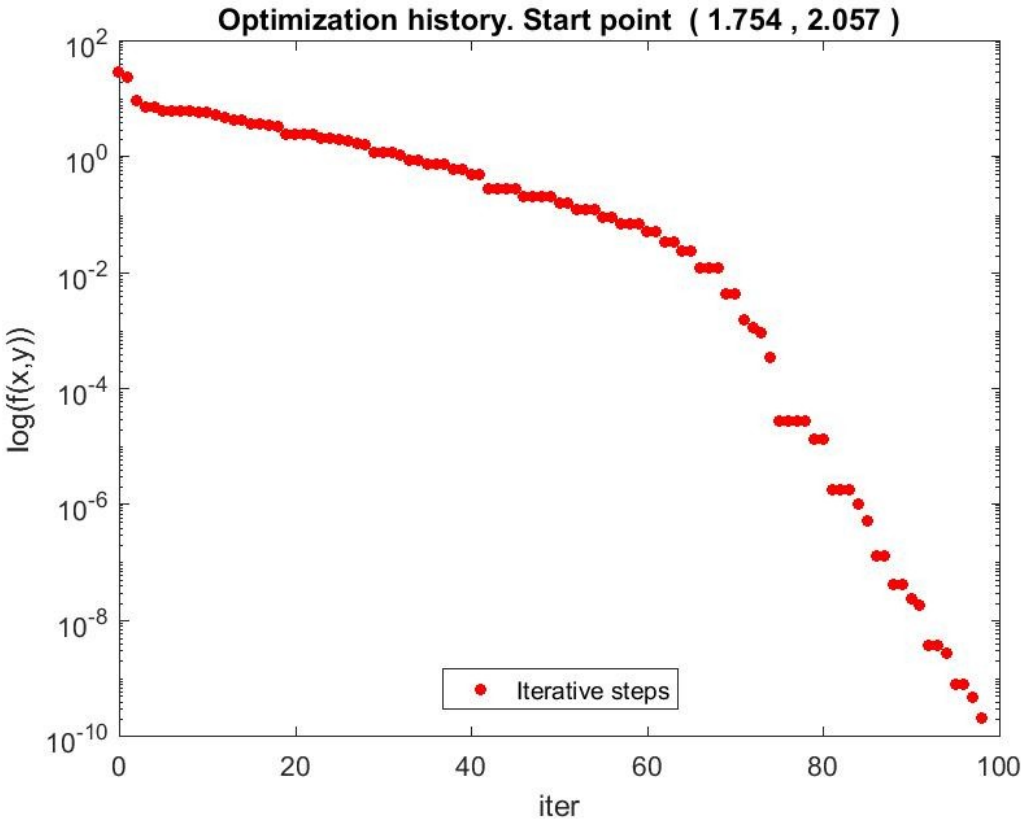

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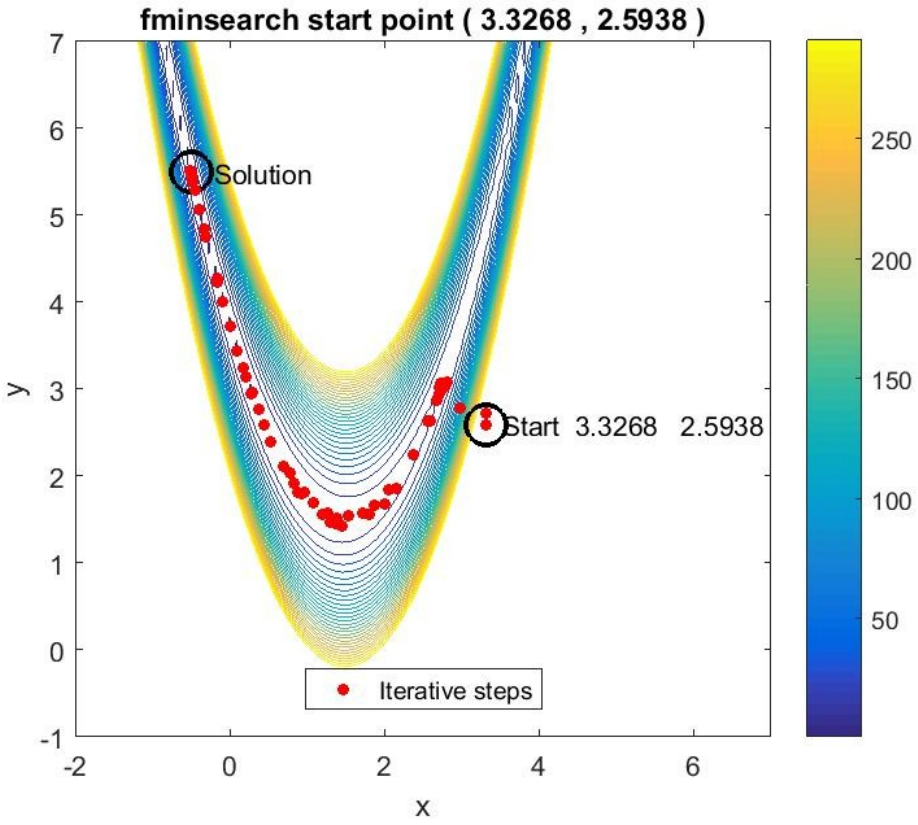

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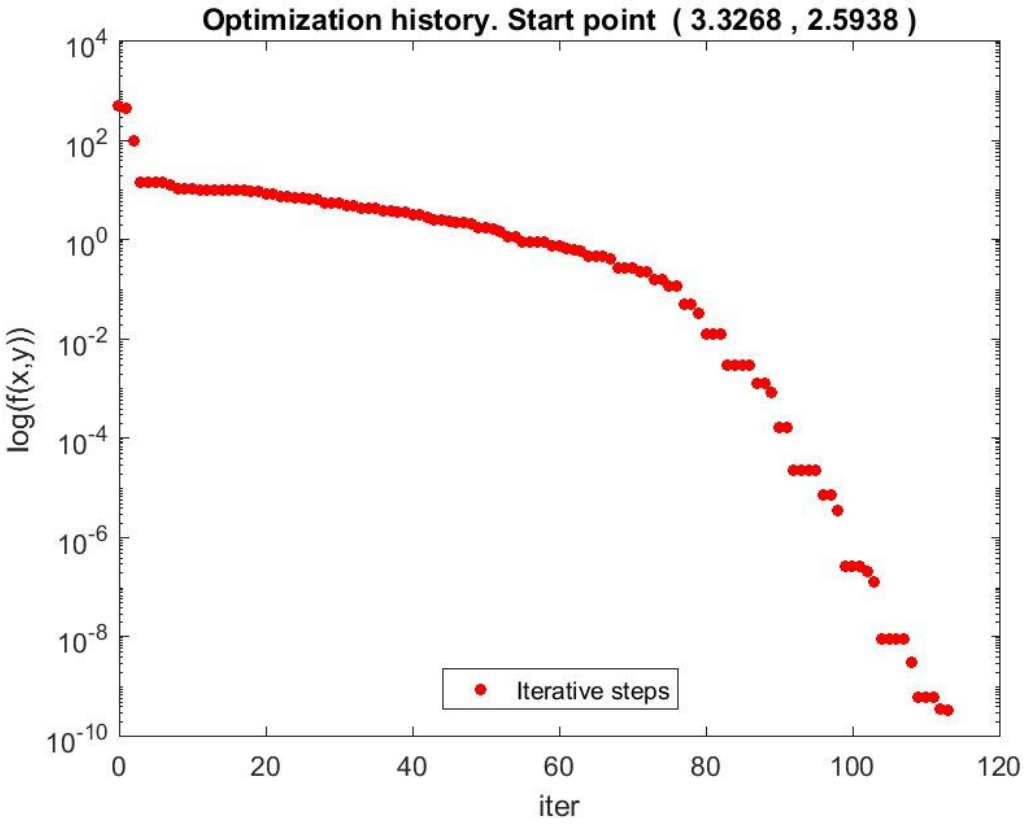

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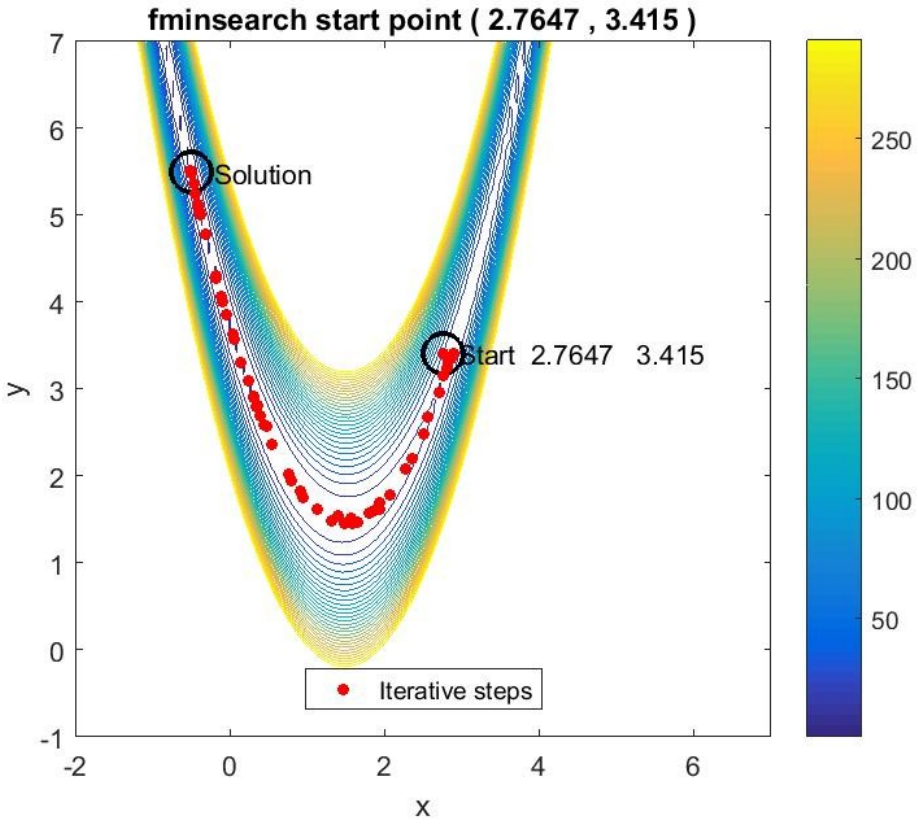

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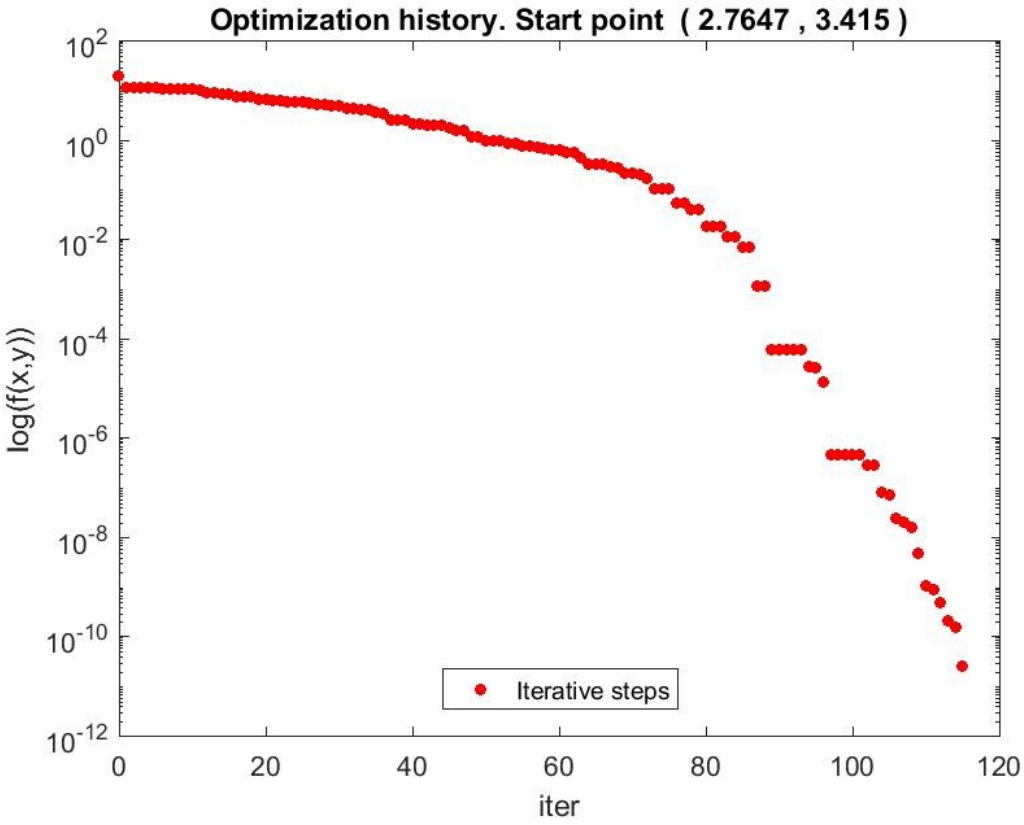

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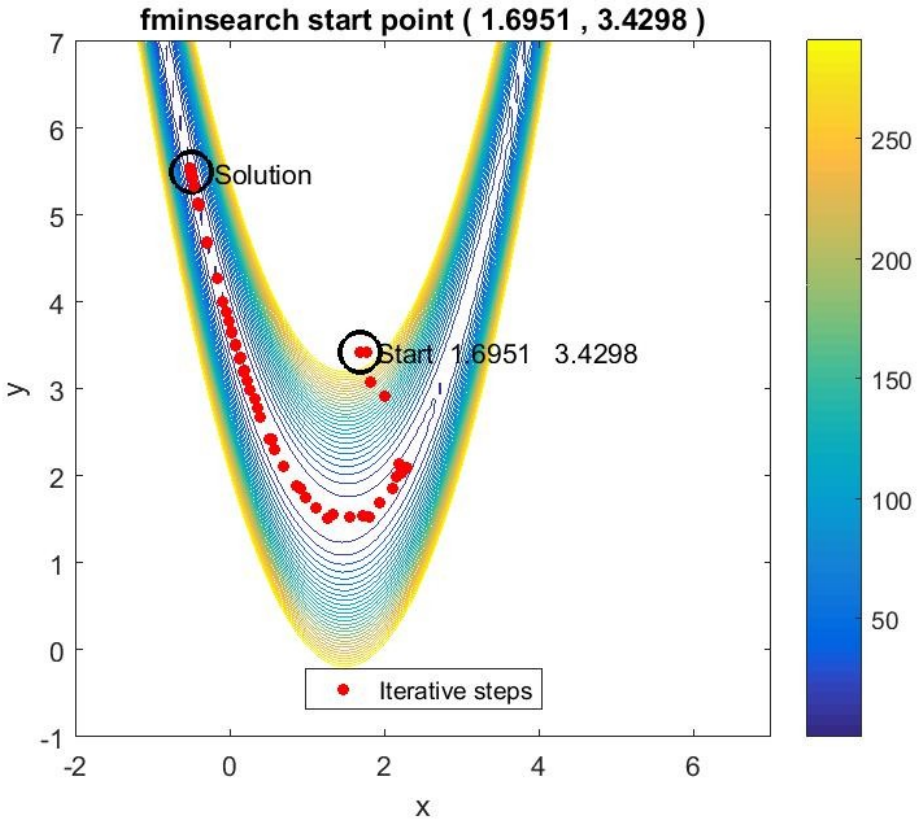

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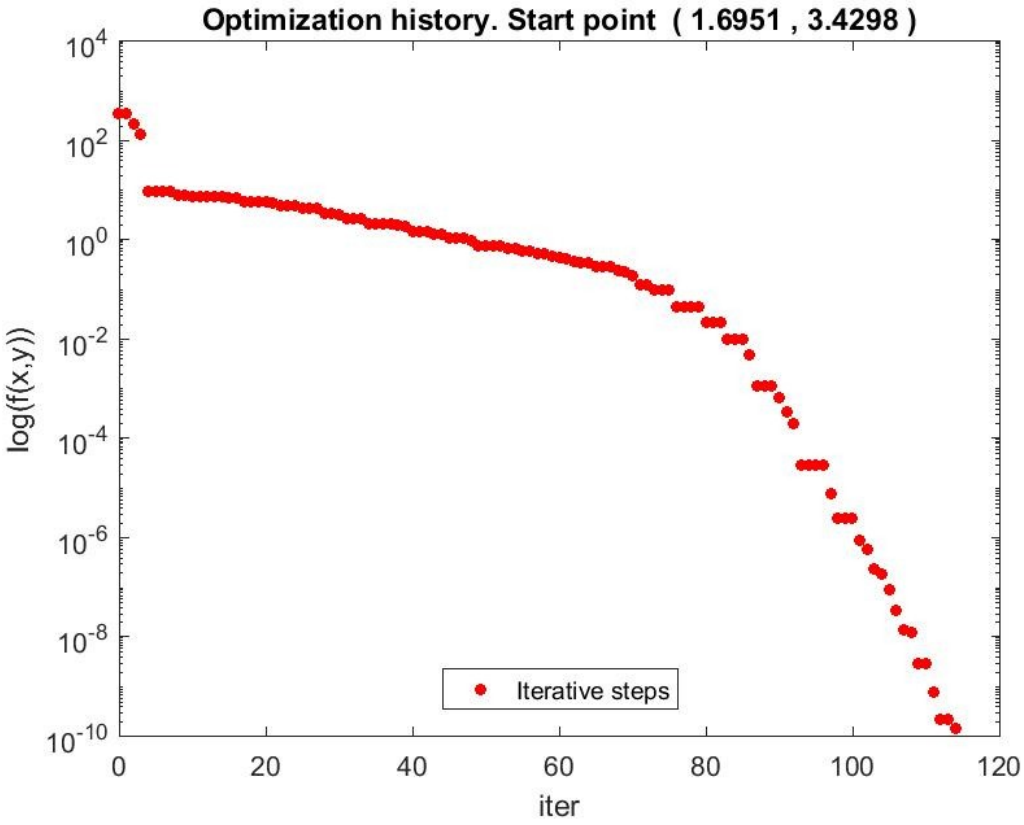

Fminunc algorithm quasi newton

x	y	Nº f evaluations	Nº solver iterations	F min
1,753	2,056	135	32	0
3,326	2,593	171	48	0
2,764	3,415	177	46	0
1,695	3,429	189	38	0

(Script OptimfminuncQuasiNewtonRosenbrock.mat)

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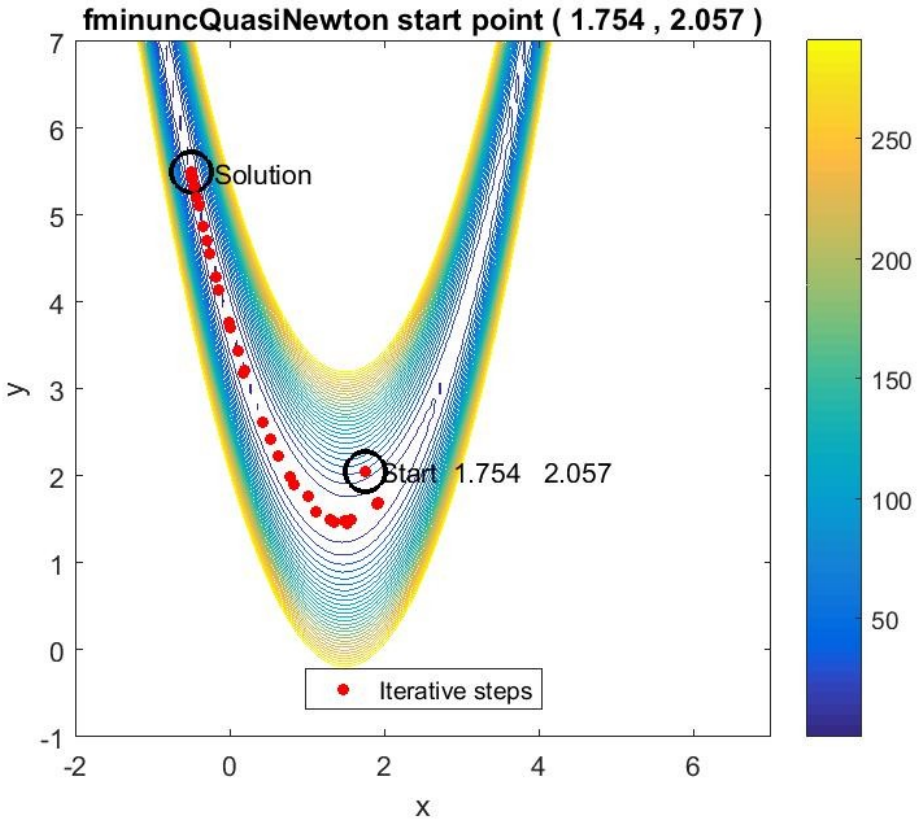

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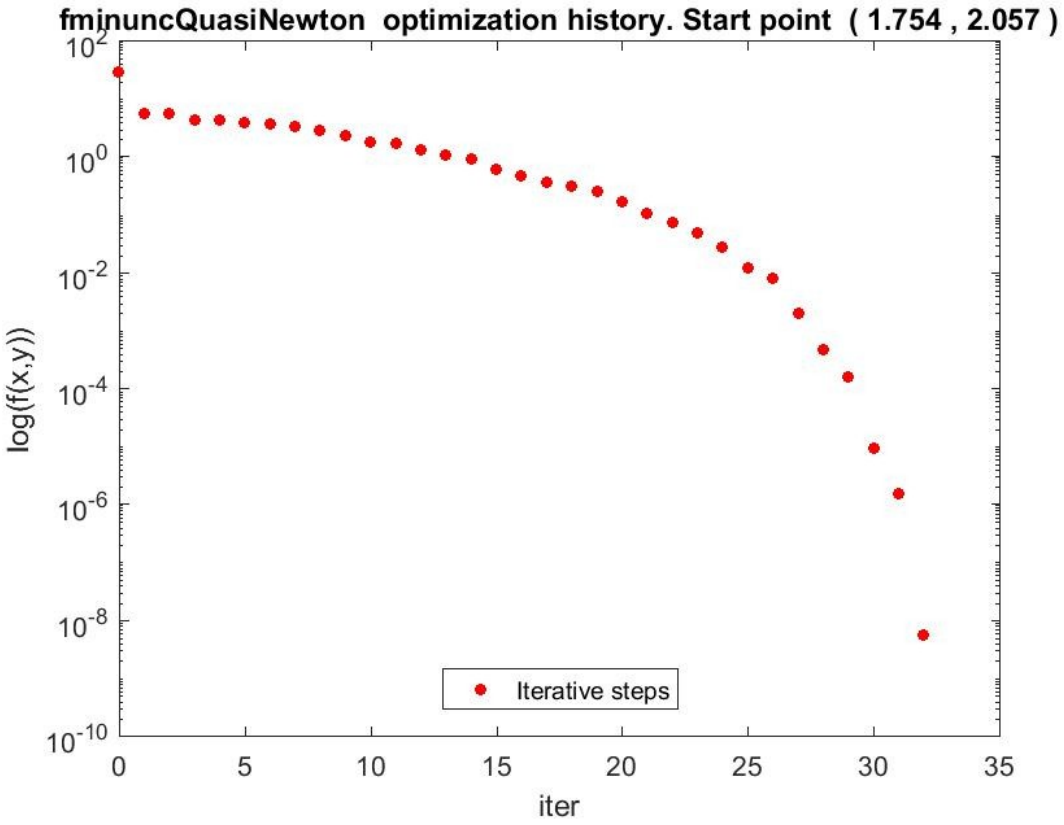

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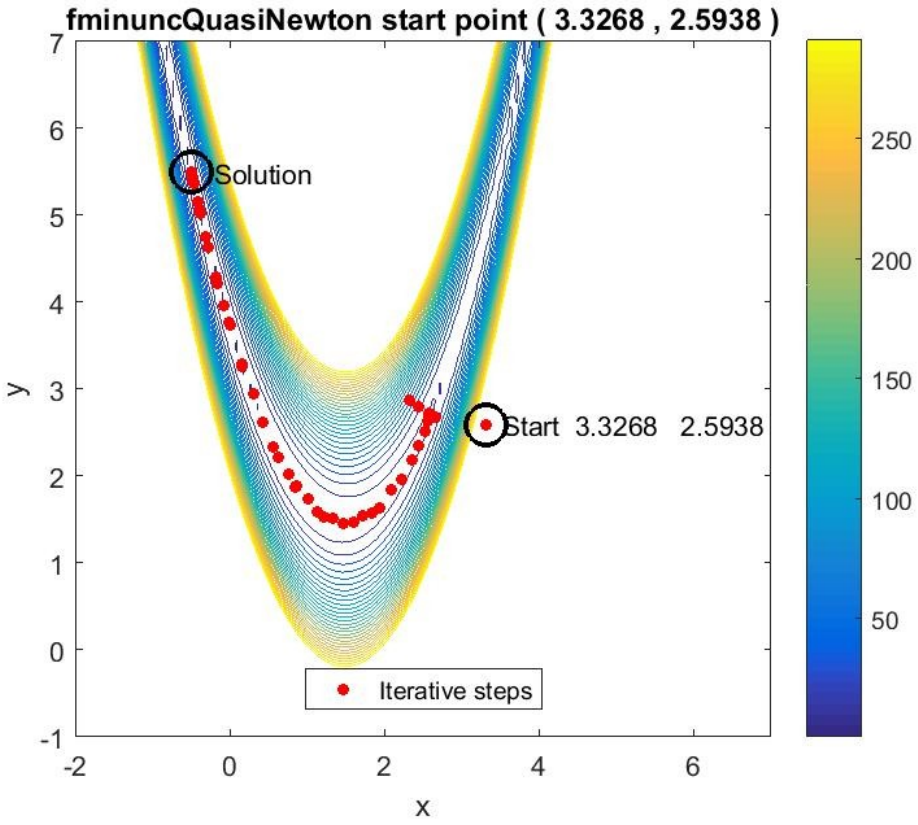

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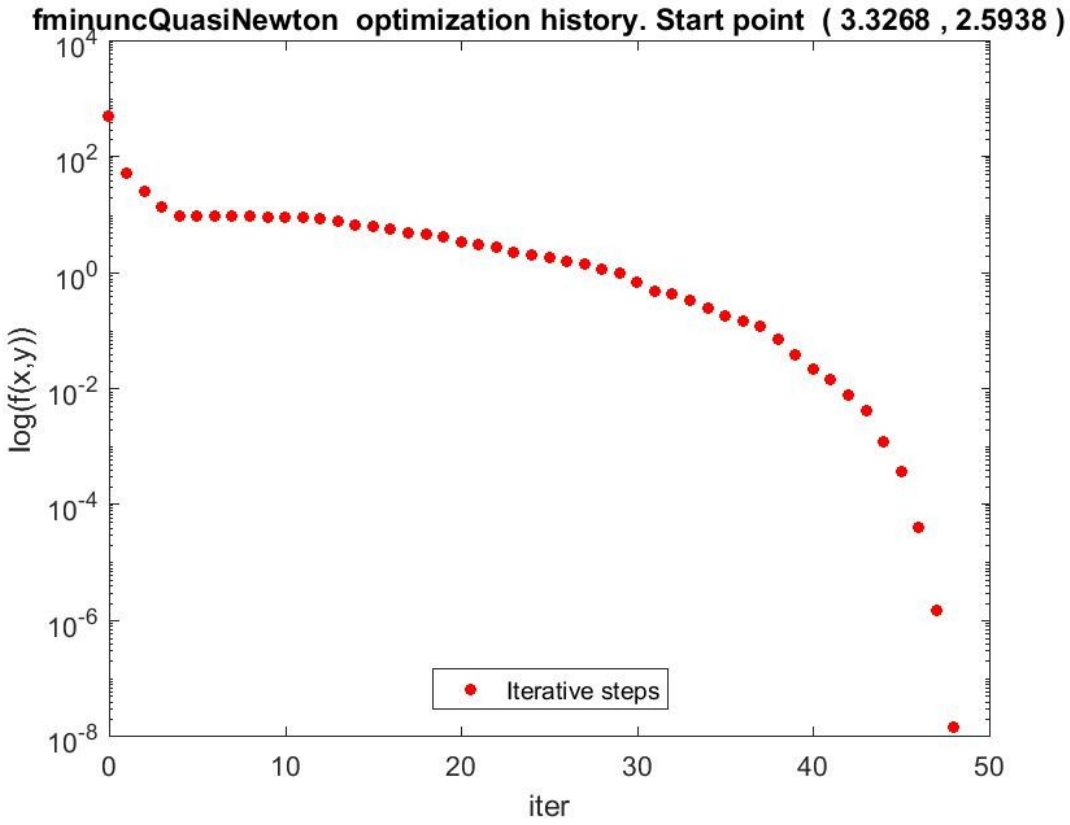

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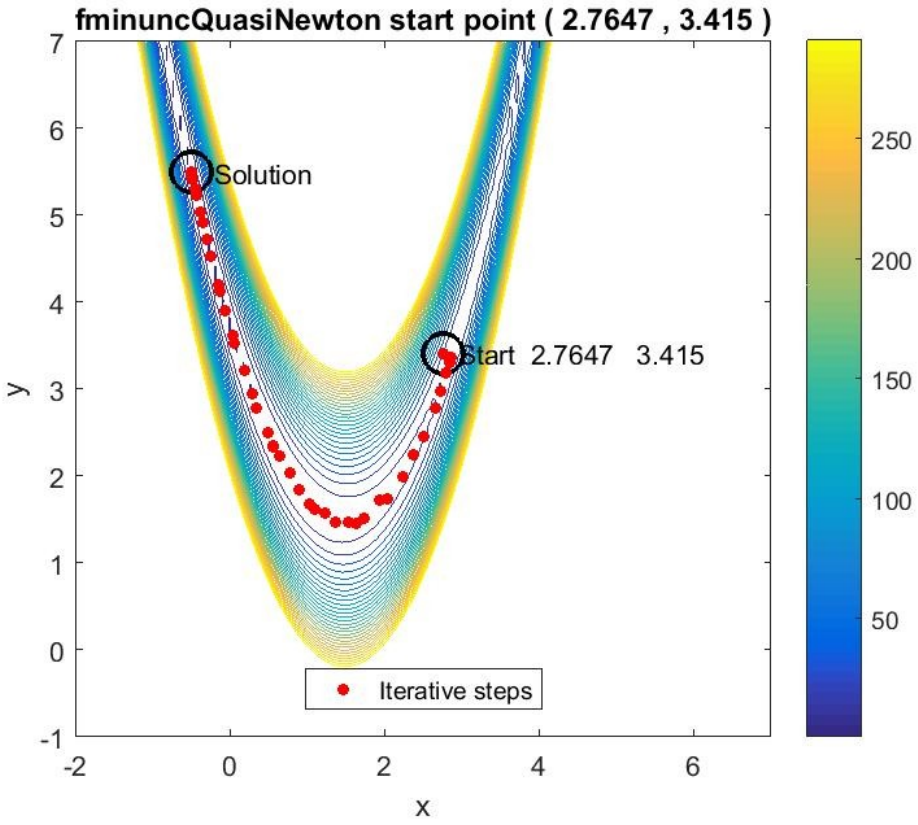

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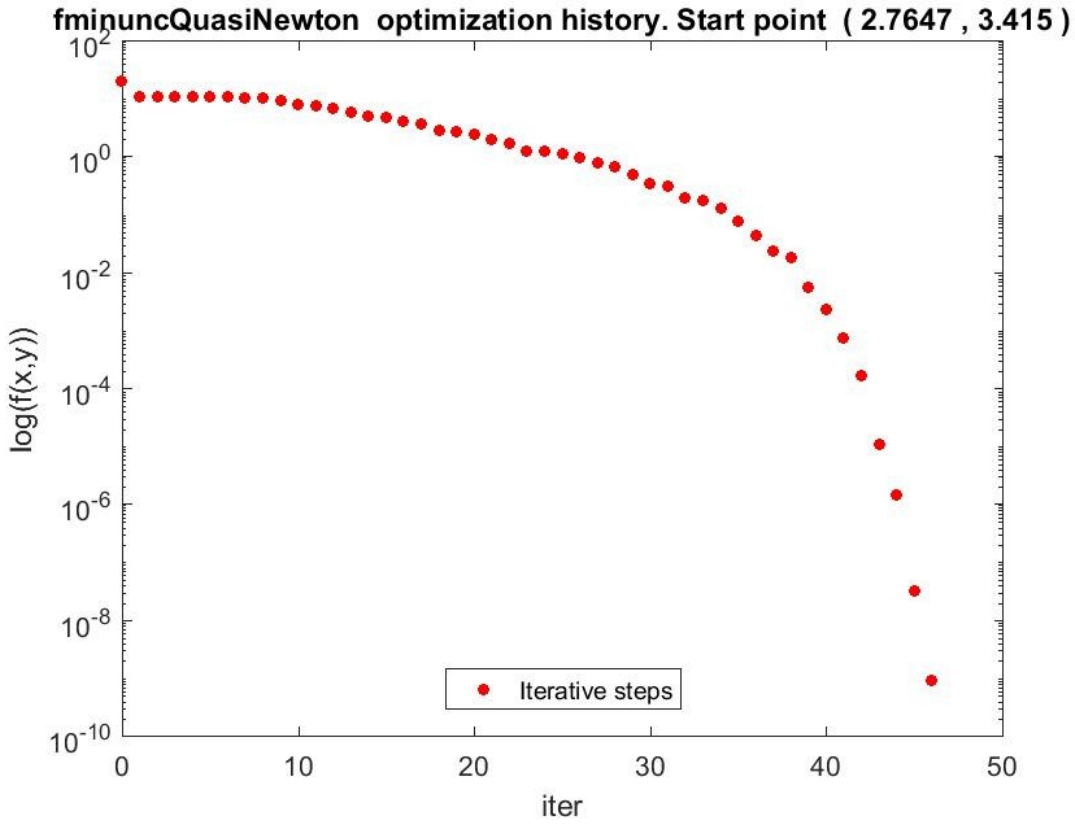

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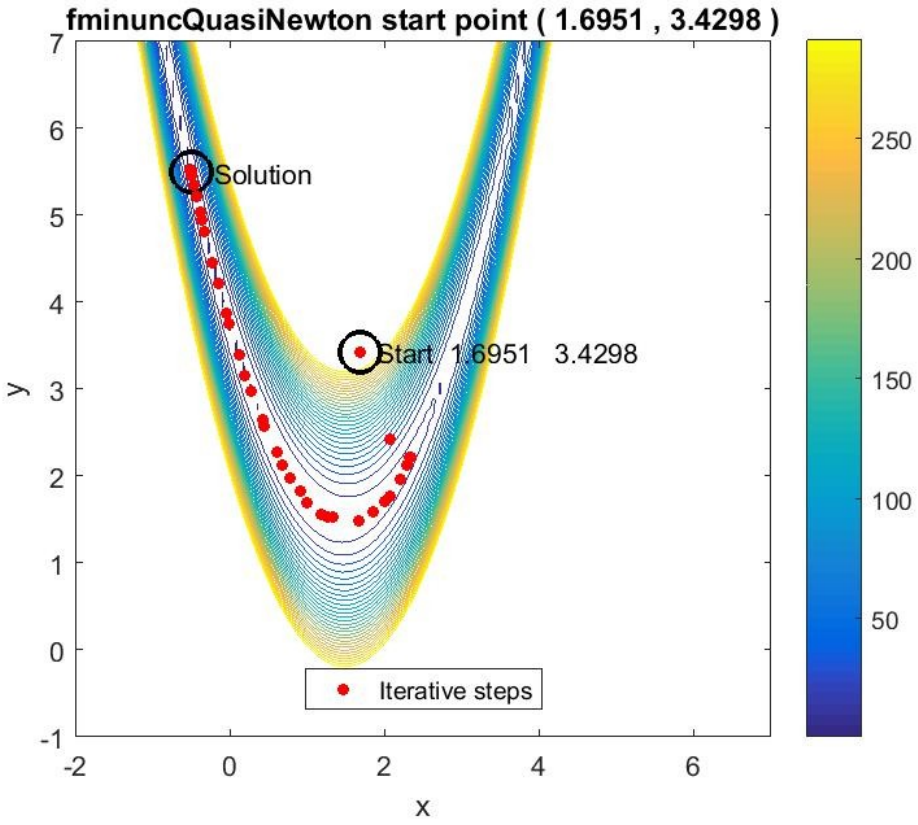

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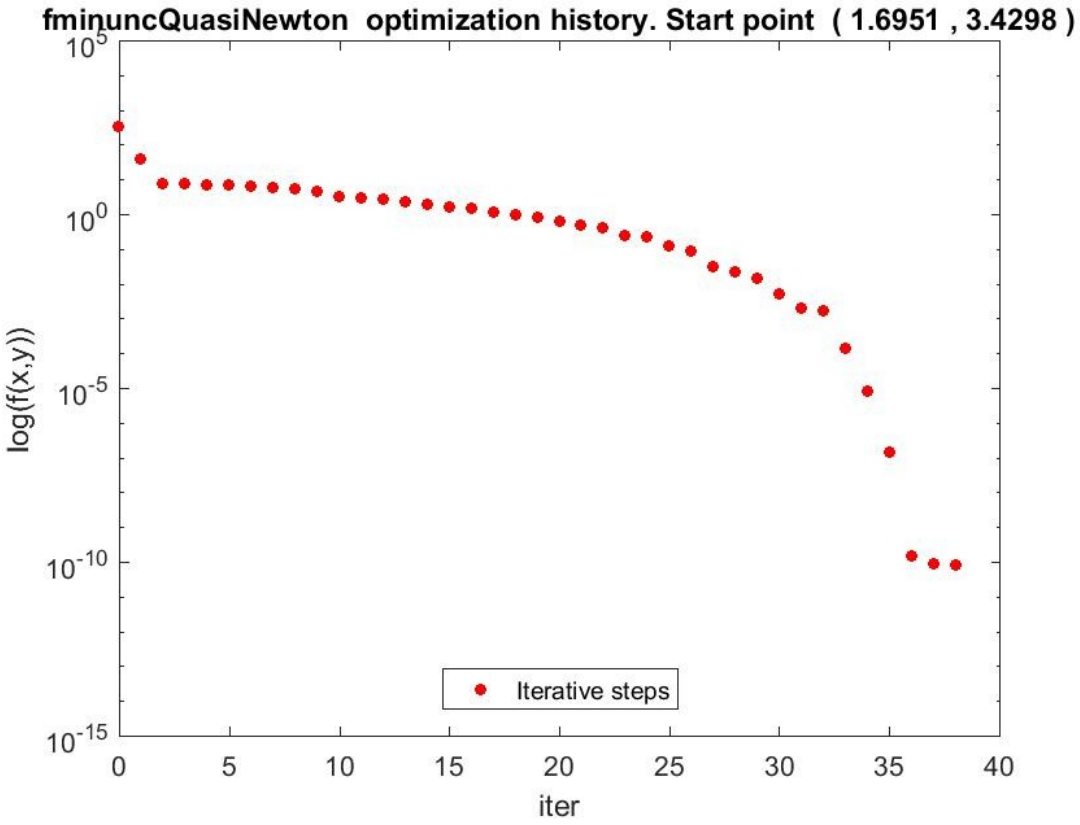

Fminunc algorithm steepest descend

x	y	Nº f evaluations	Nº solver iterations	F min
1,7539	2,0569	2331	201	0,6999
3,3267	2,5937	2124	201	0,0003
2,7647	3,4150	2550	201	0,1298
1,6950	3,4297	2196	201	0,0004

(Script OptimfminuncSteepestDescendRosenbrock.mat)

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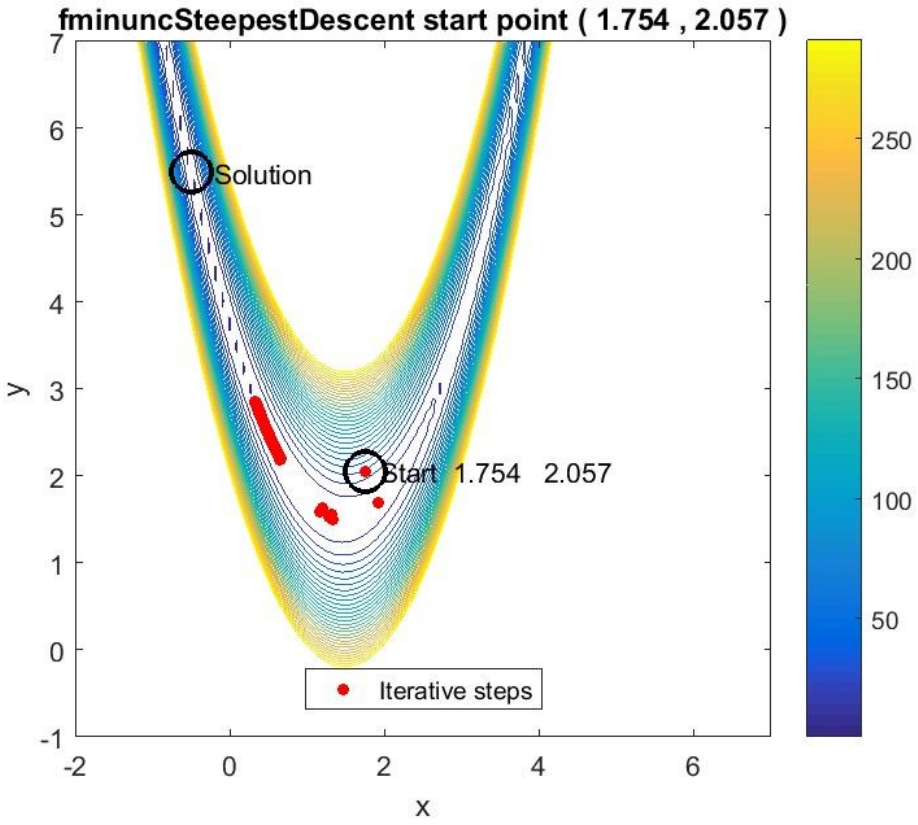

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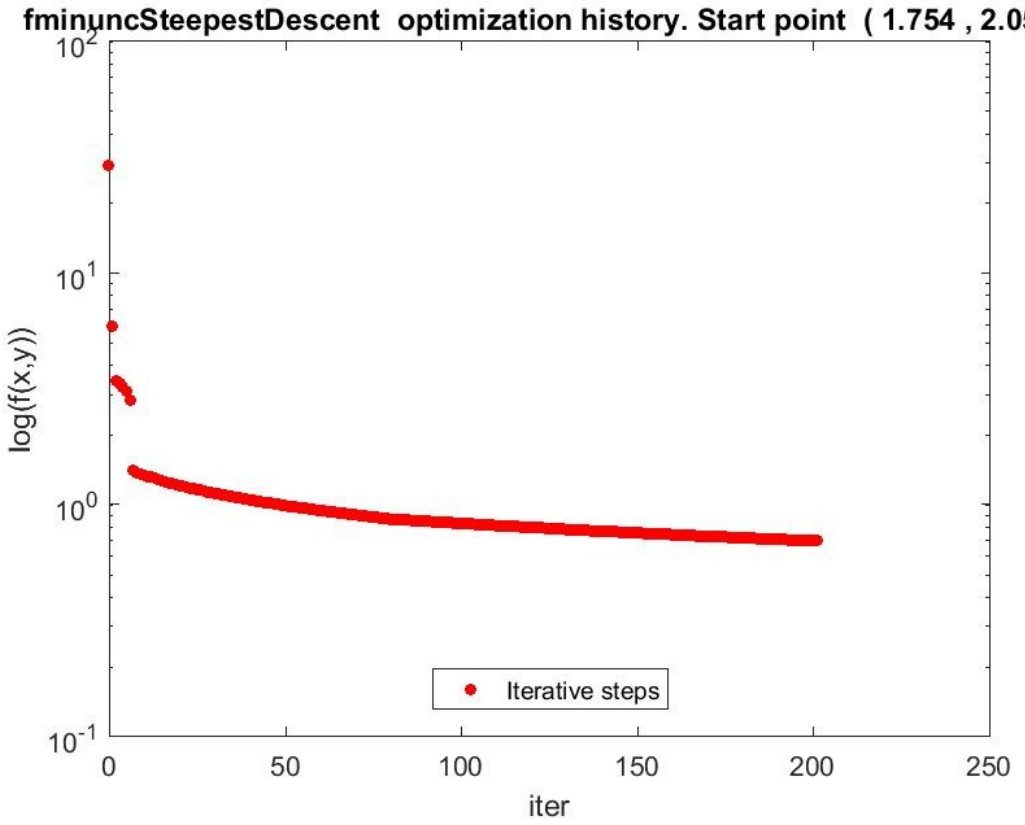

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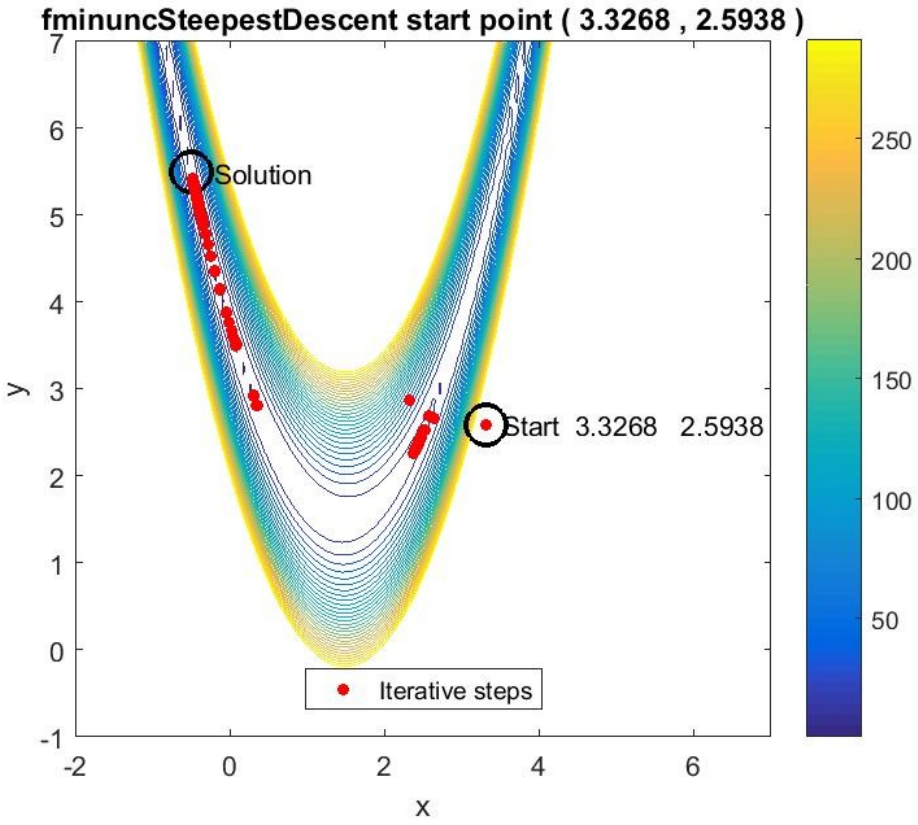

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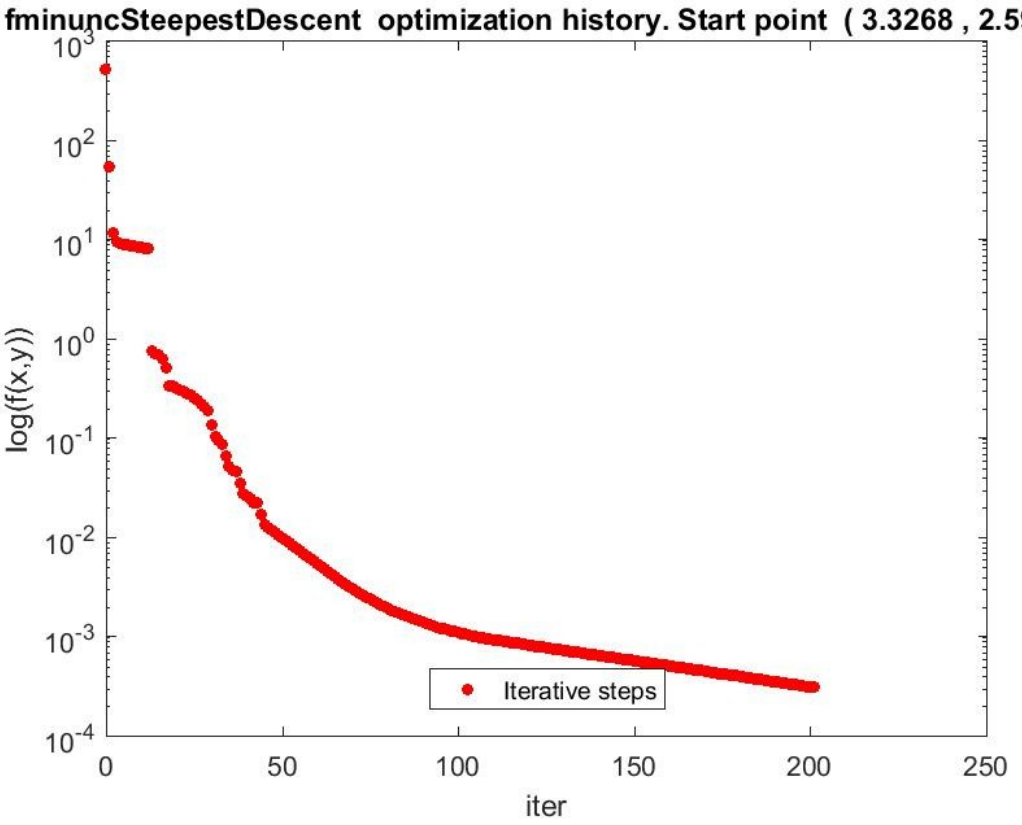

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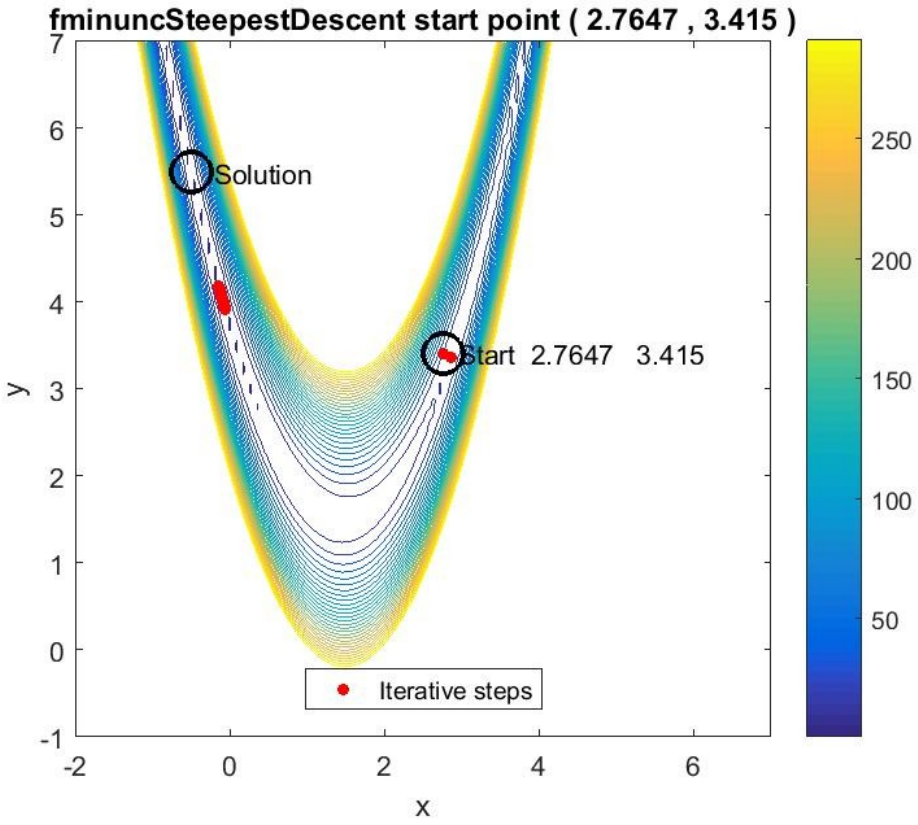

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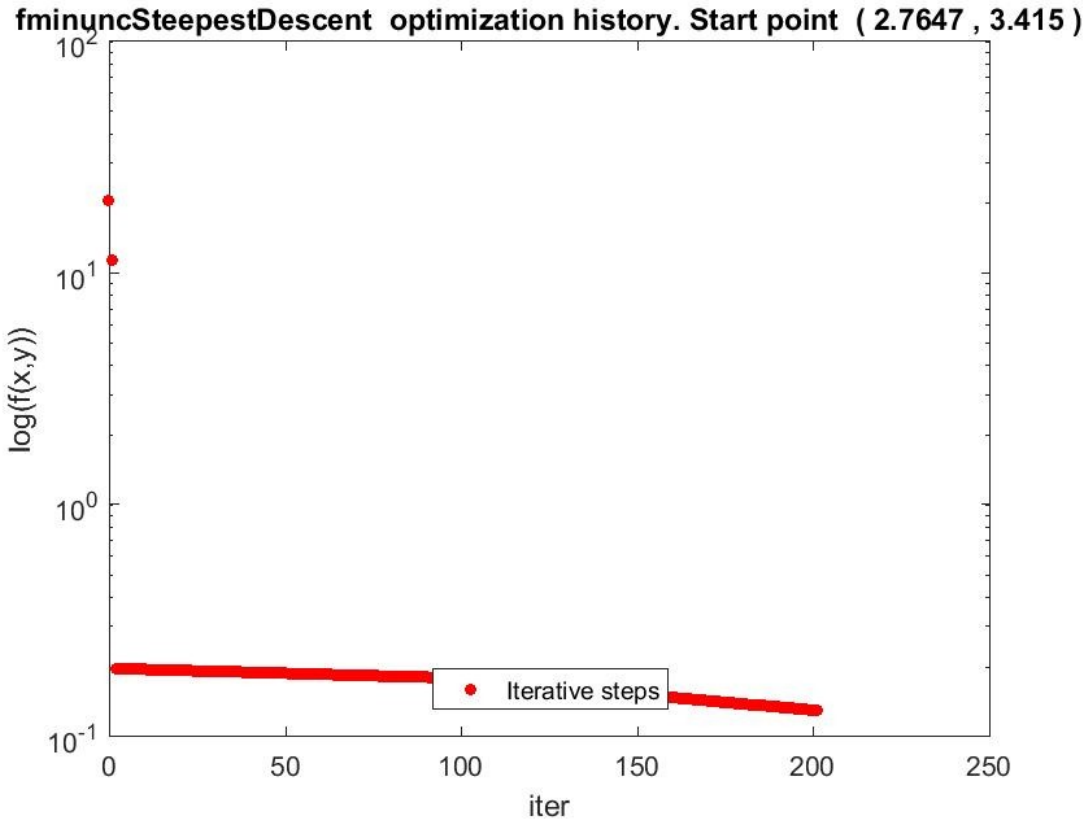

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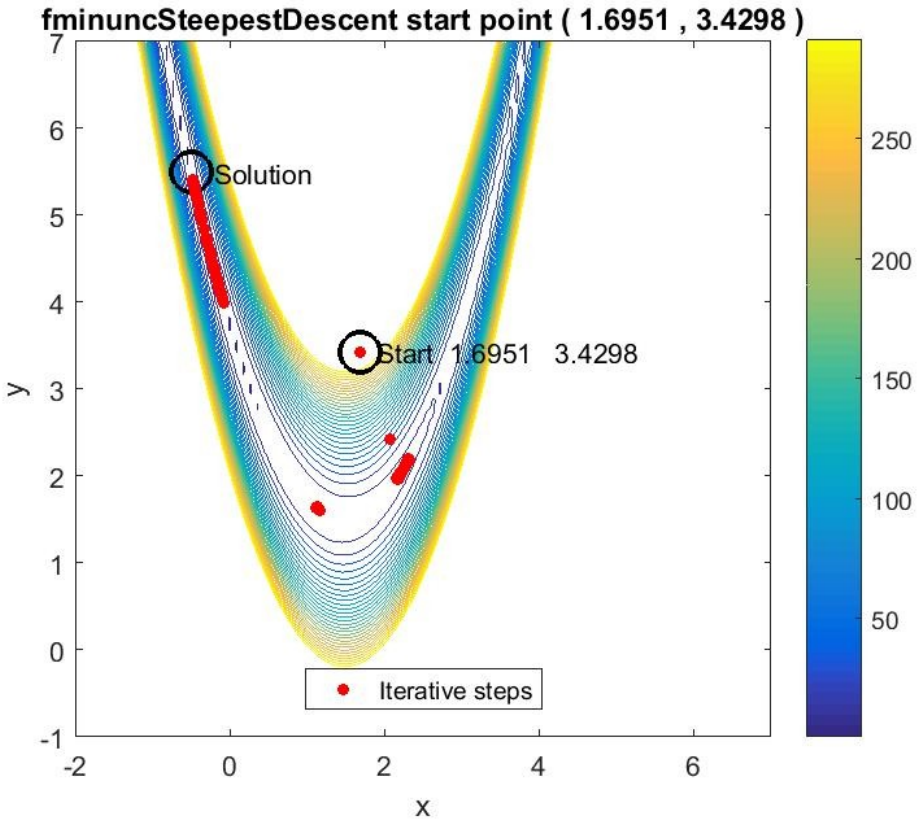

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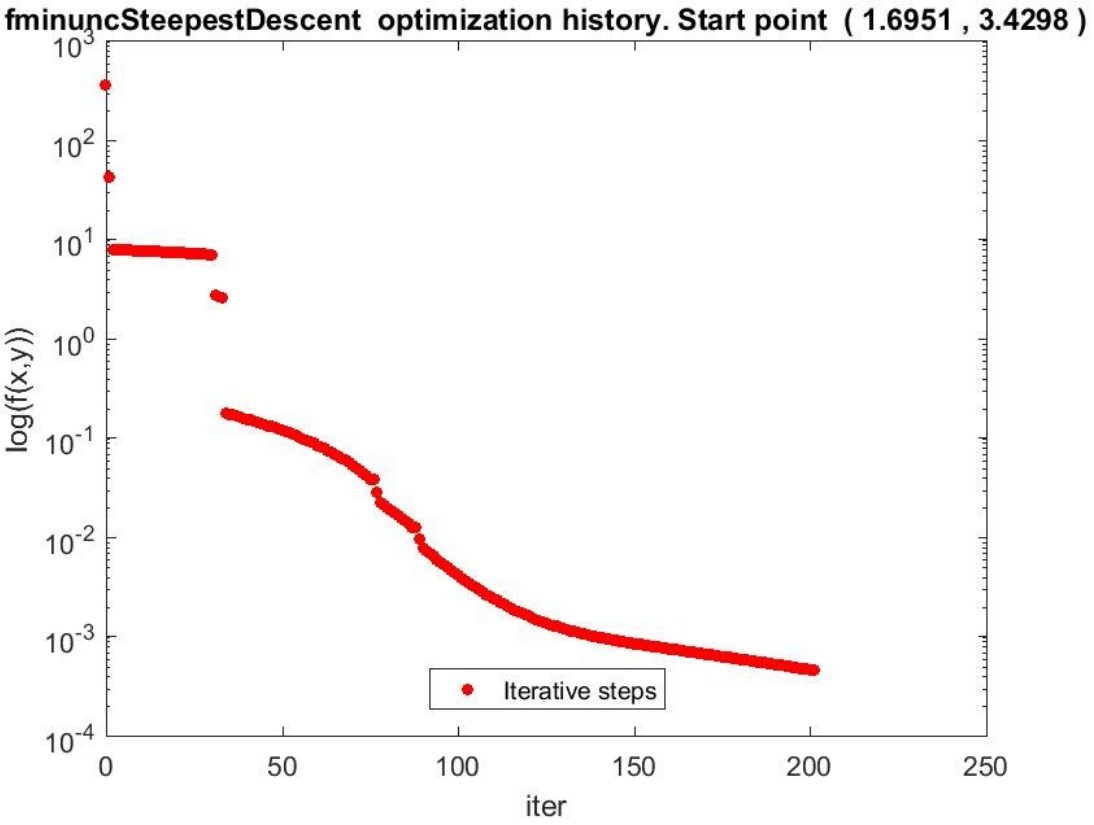

Fminunc algorithm Quasi Newton Trust Region (algorithm with gradient)

x	y	Nº f evaluations	Nº solver iterations	F min
1,7539	2,0569	30	29	1,2832e-15
3,3267	2,5937	35	34	7,3822e-11
2,7647	3,4150	37	36	2,0515e-16
1,6950	3,4297	38	37	8,2559e-15

(Script OptimfminuncRosenbrockQuasiNewtonTrustRegion.mat)

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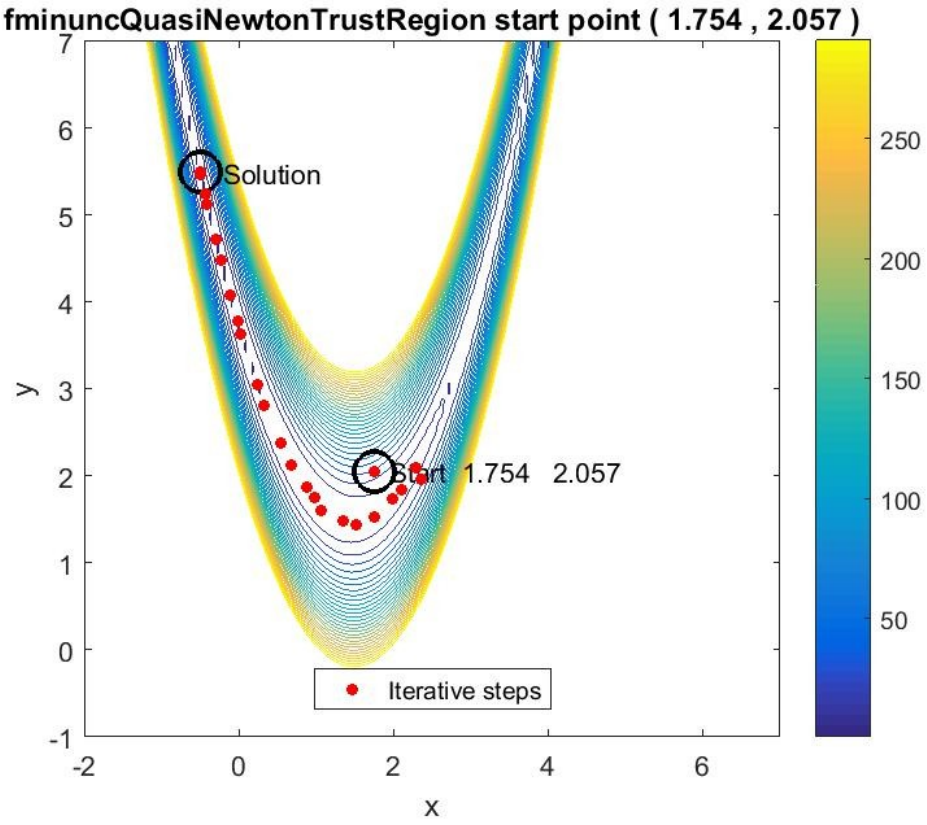

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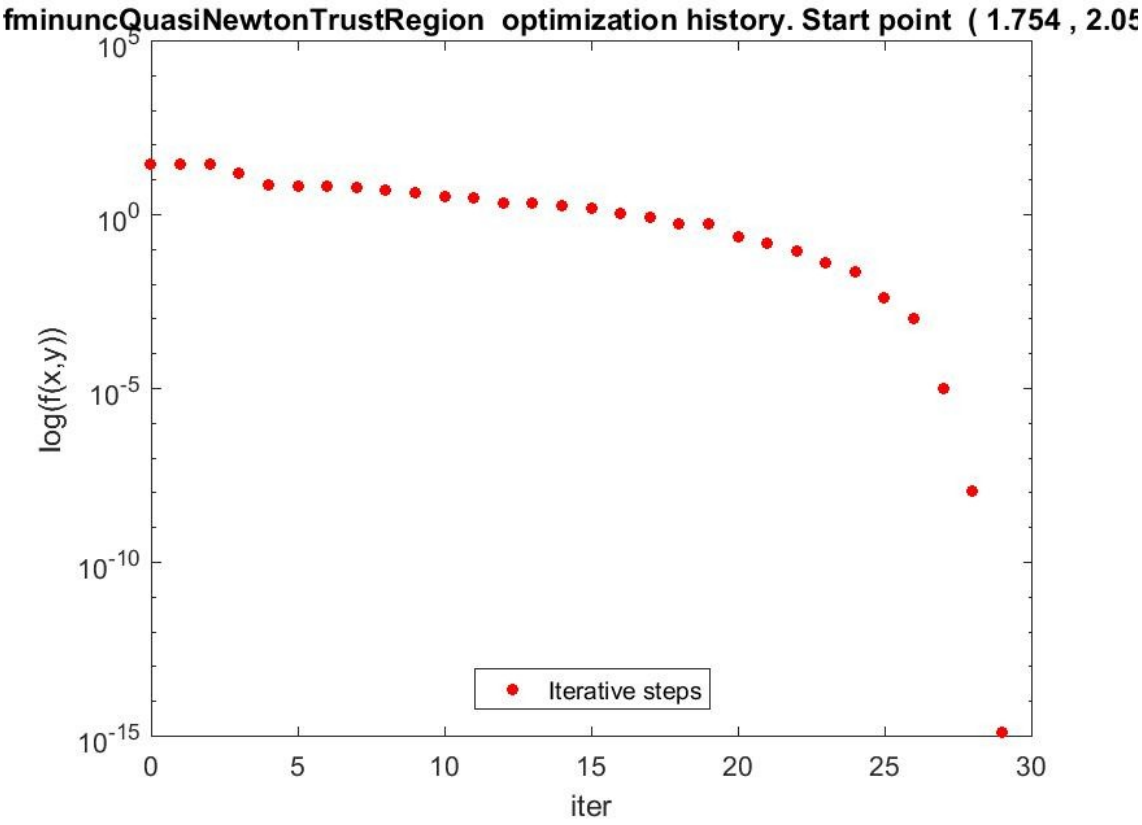

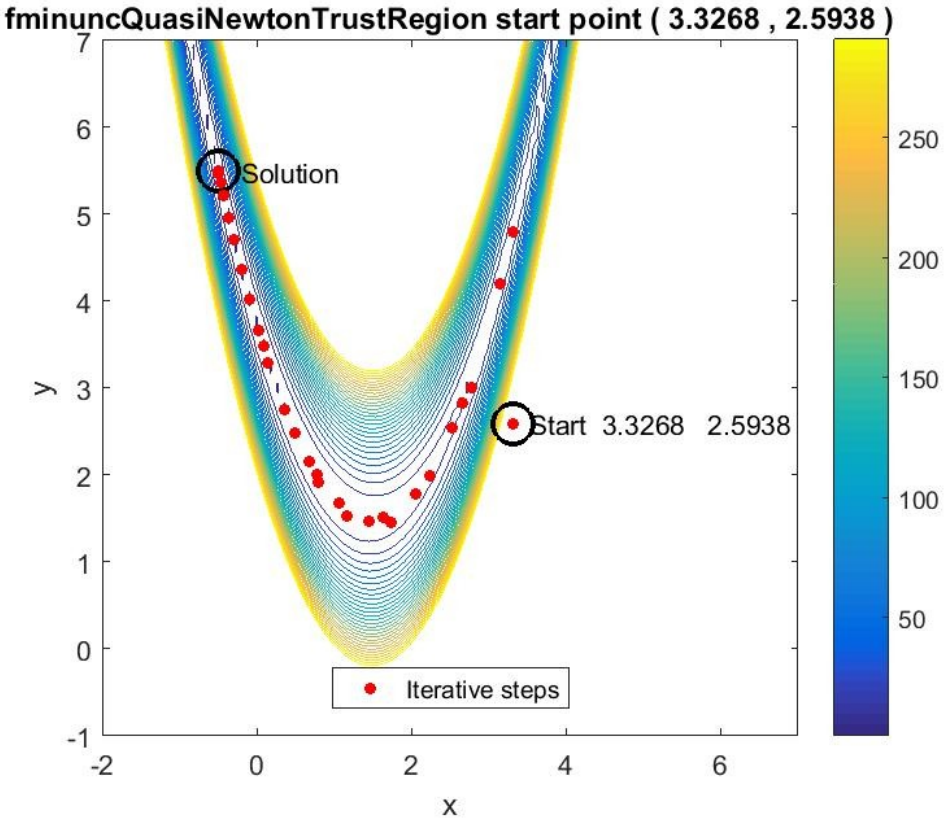

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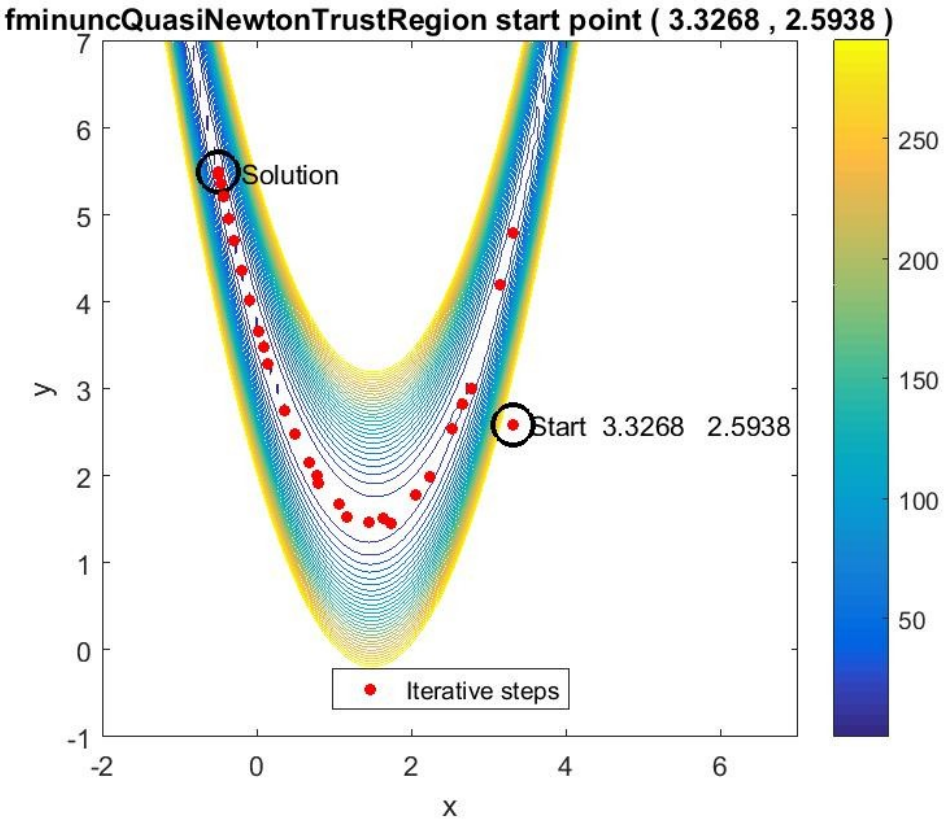

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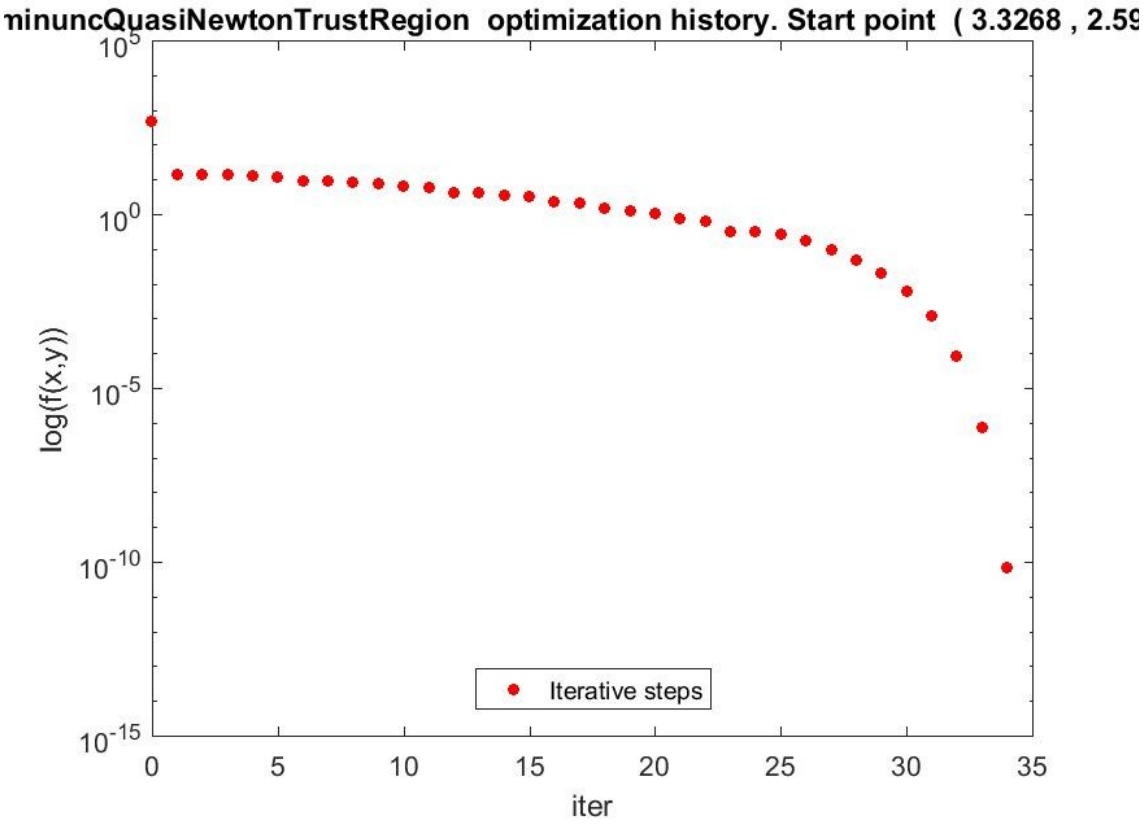

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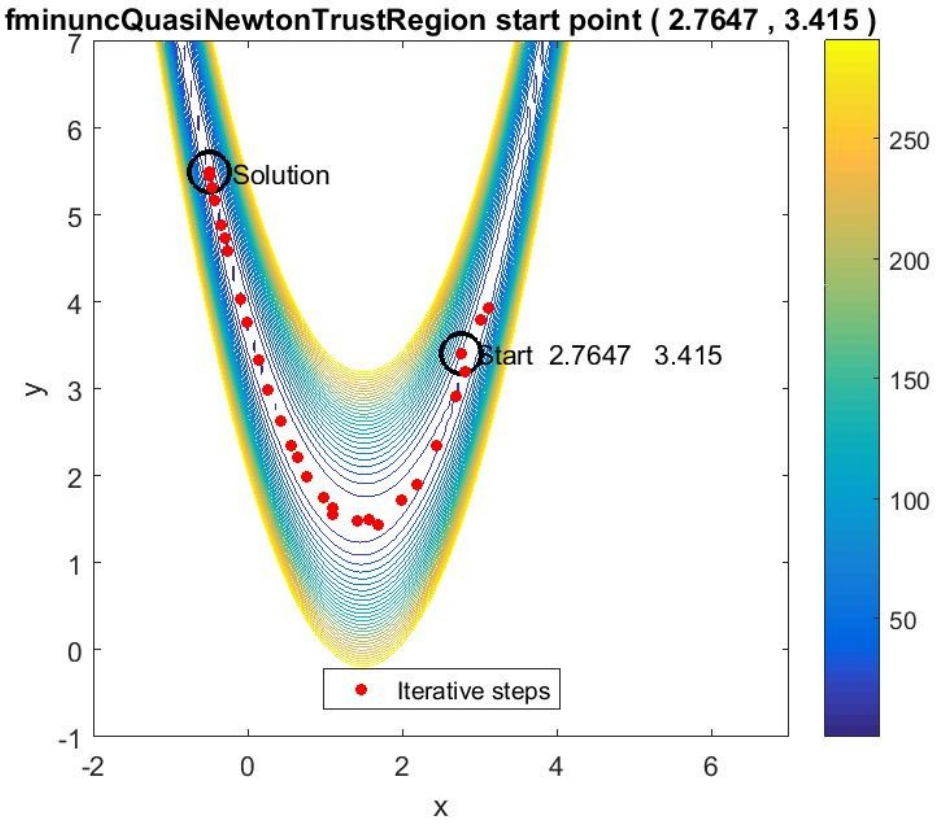

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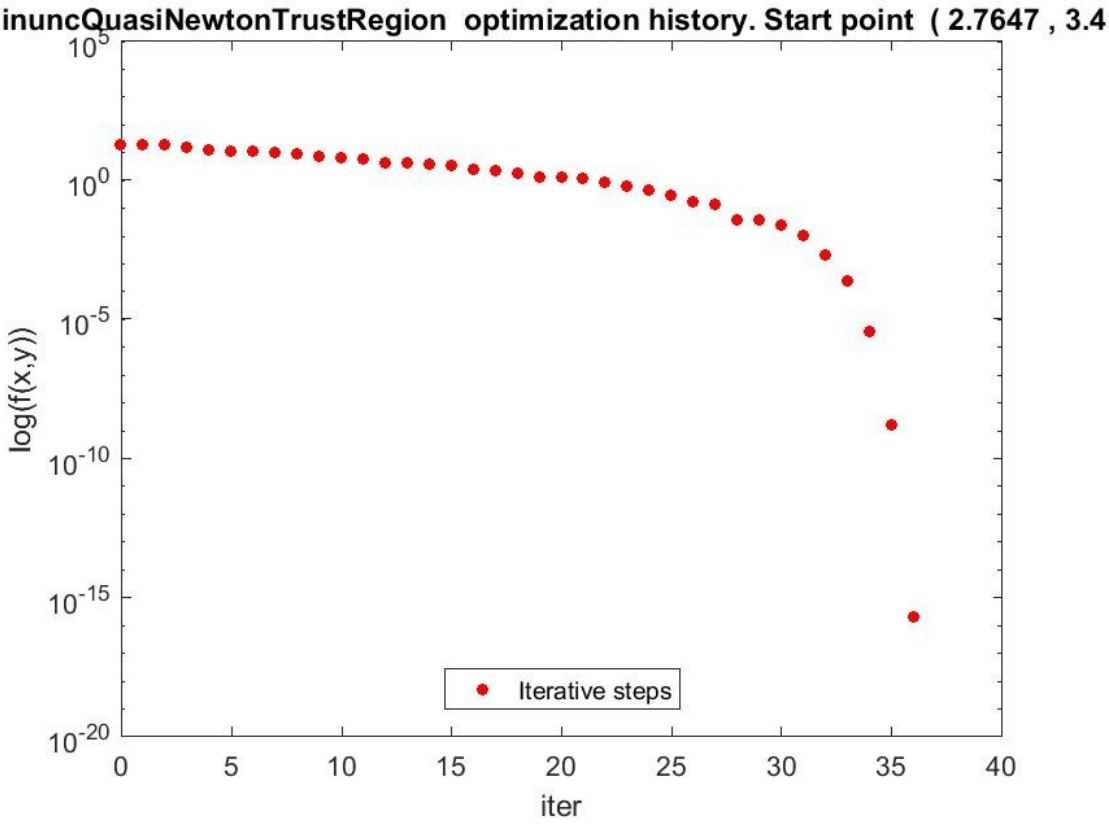

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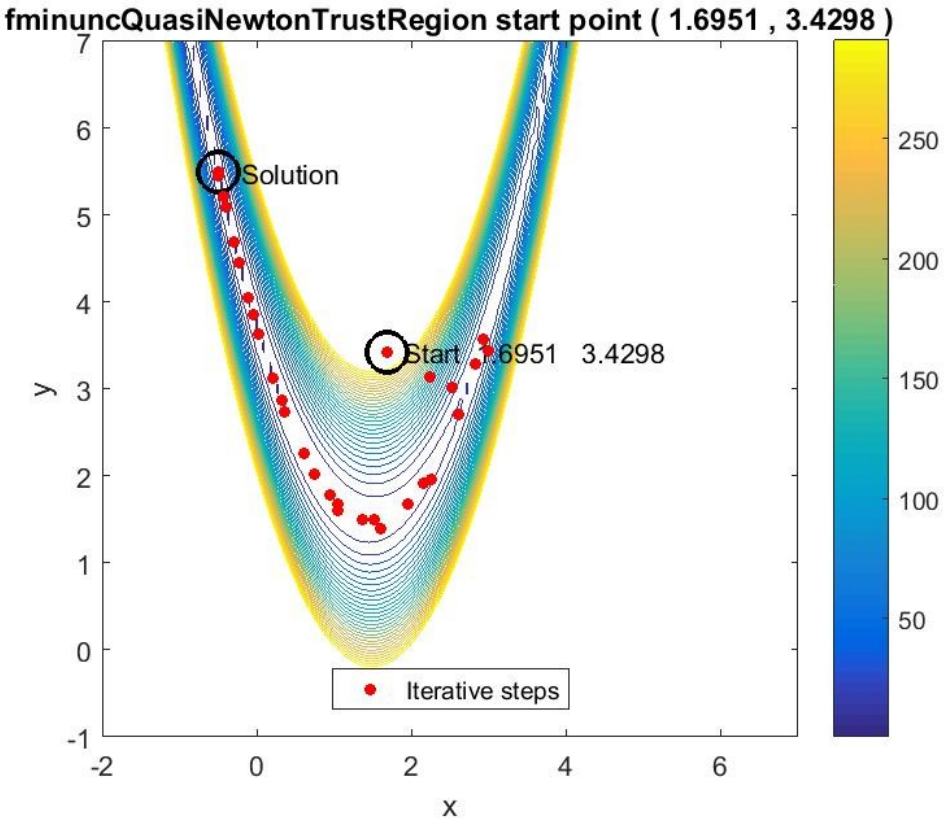

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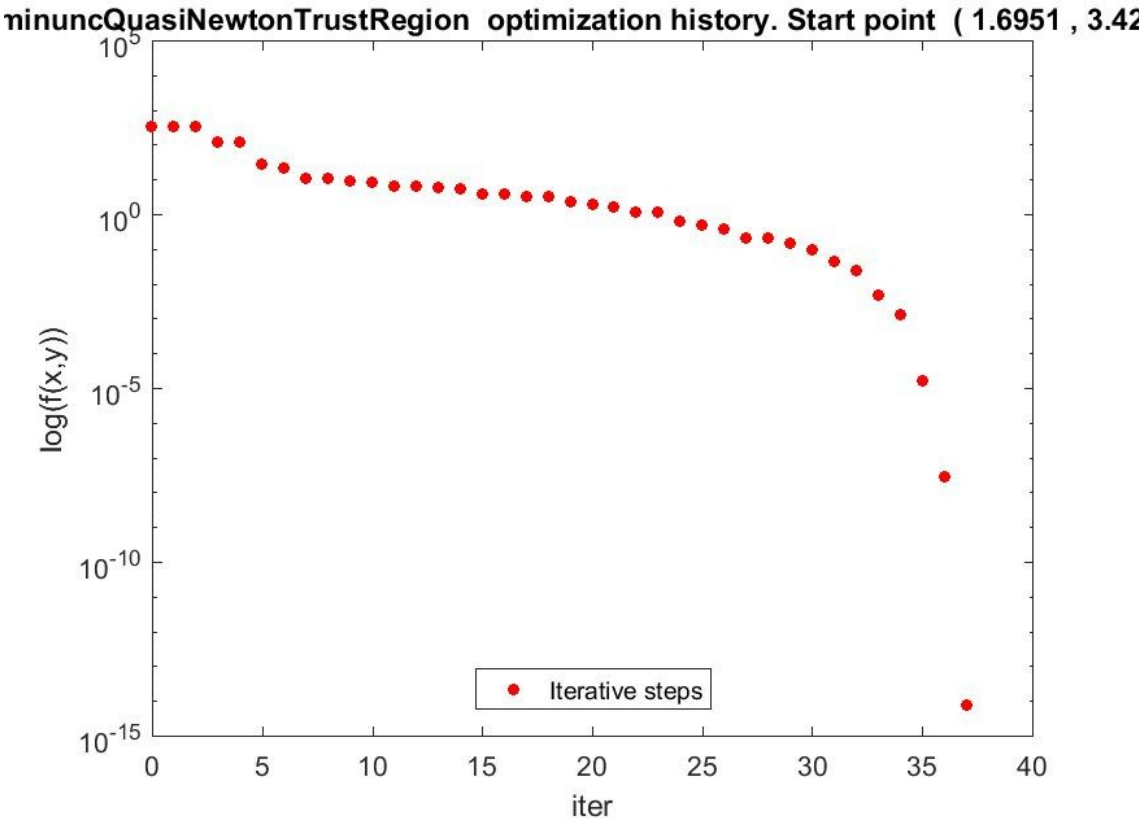

Fminunc algorithm Quasi Newton Trust Region (algorithm with gradient and hessian)

x	y	Nº f evaluations	Nº solver iterations	F min
1,7539	2,0569	30	29	1,2832e-15
3,3267	2,5937	35	34	7,3822e-11
2,7647	3,4150	37	36	2,0515e-16
1,6950	3,4297	38	37	8,2559e-15

(Script OptimfminuncRosenbrockQuasiNewtonTrustRegion)

The same outputs, hessian matrix doesn´t help in this case.

Lsqnonli algorithm Least Squares Solver

x	y	Nº f	Nº solver	F min

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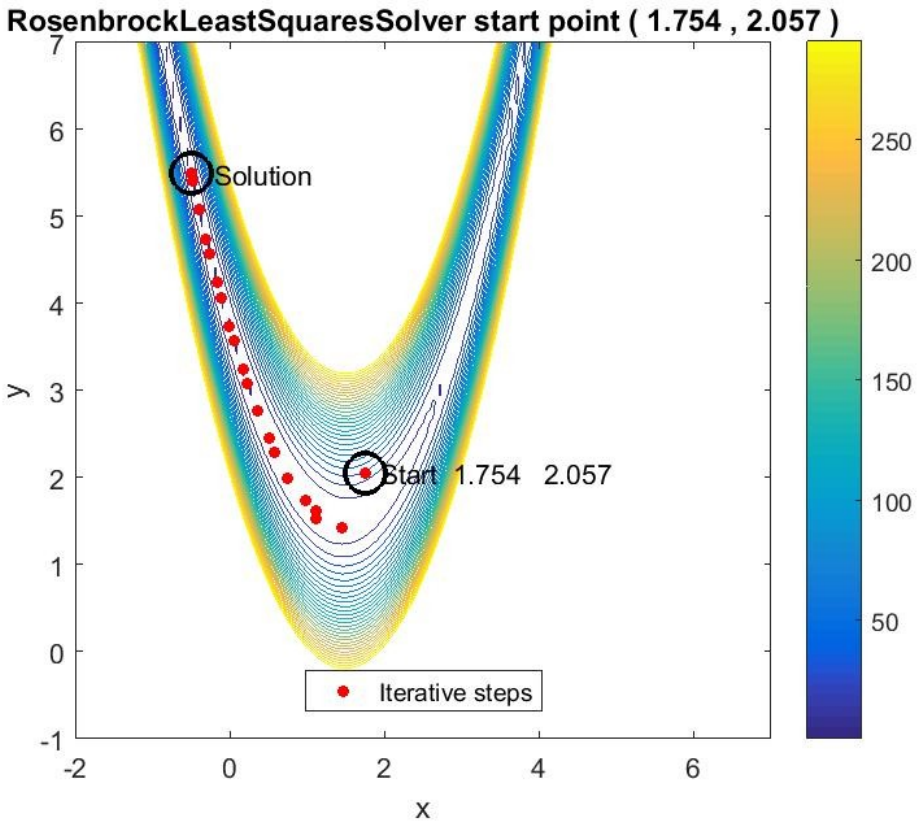
		evaluations	iterations	
1,7539	2,0569	84	27	5,0109e-23
3,3267	2,5937	75	24	3,0351e-20
2,7647	3,4150	78	25	1,2106e-19
1,6950	3,4297	81	26	2,3672e-21

(Script OptimfminuncRosenbrockLeastSquaresError.mat)



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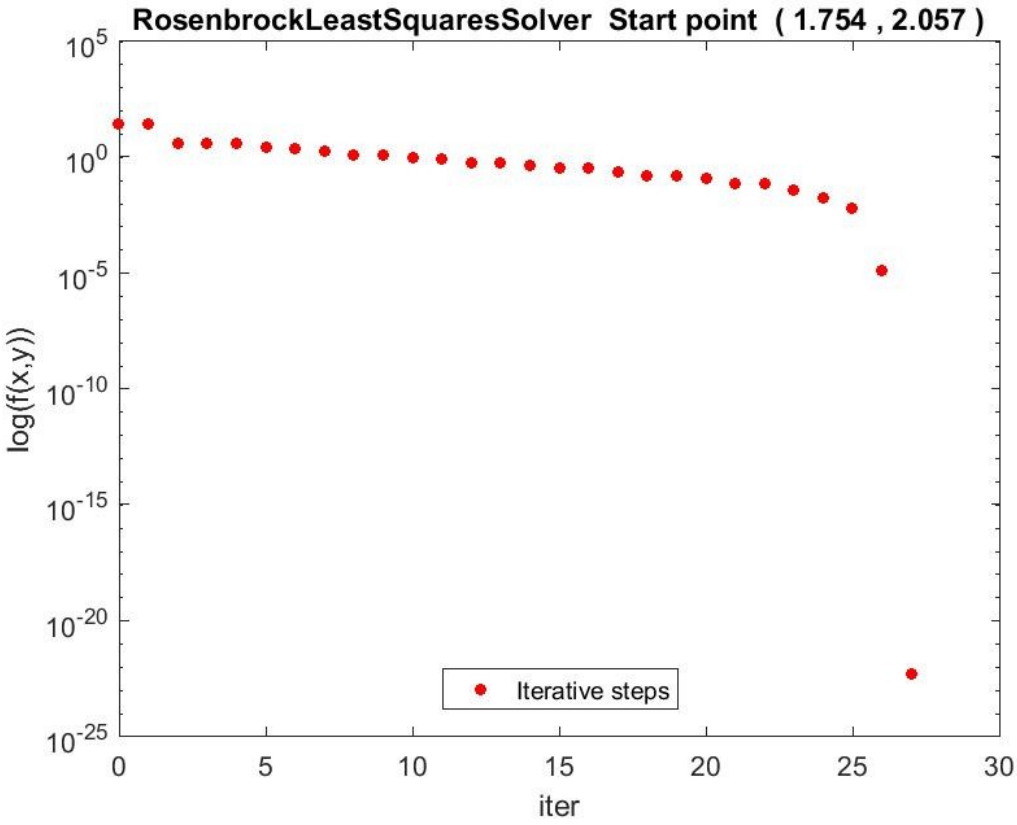

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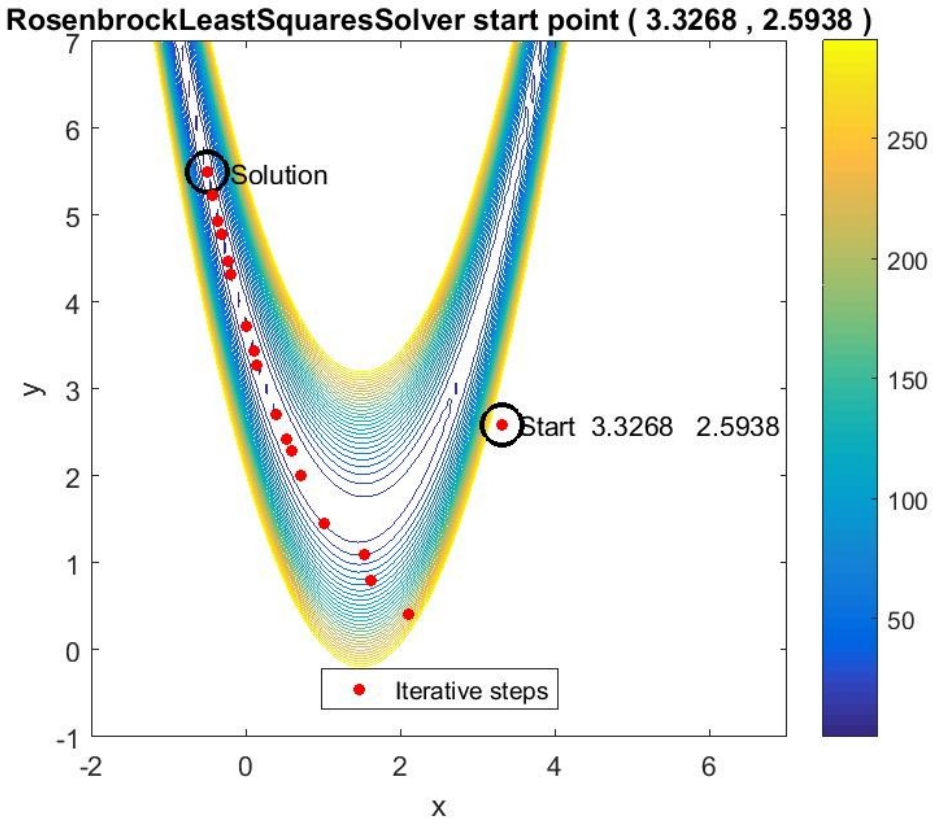

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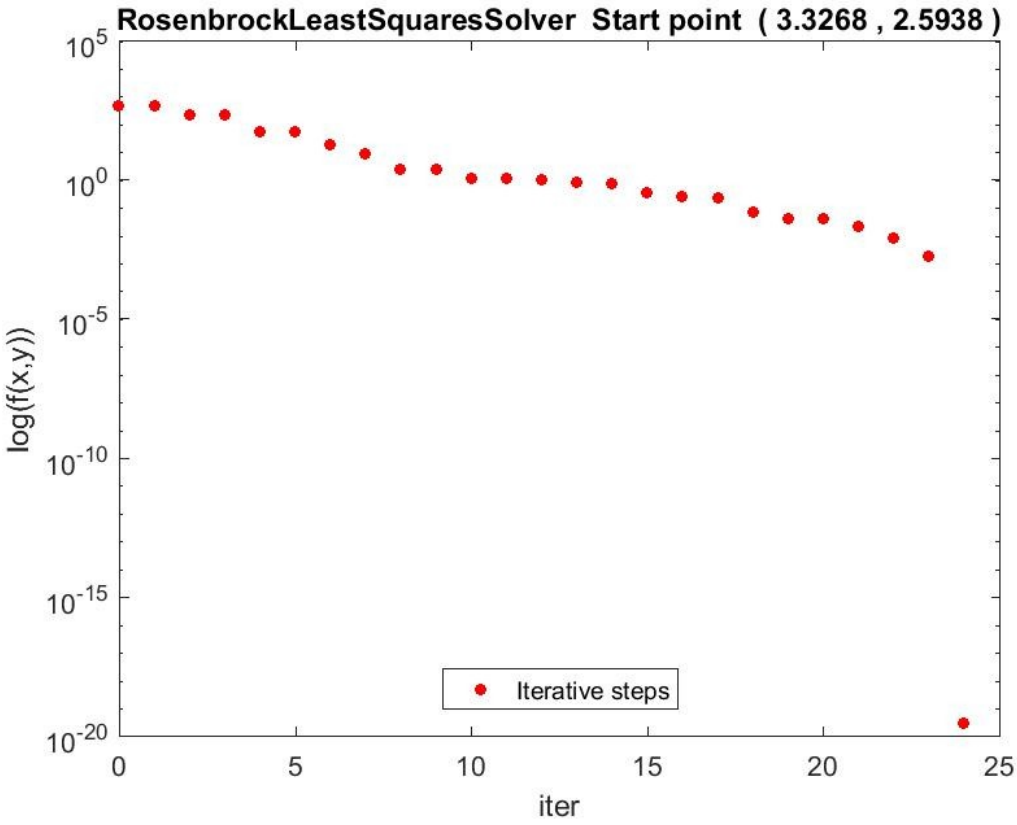

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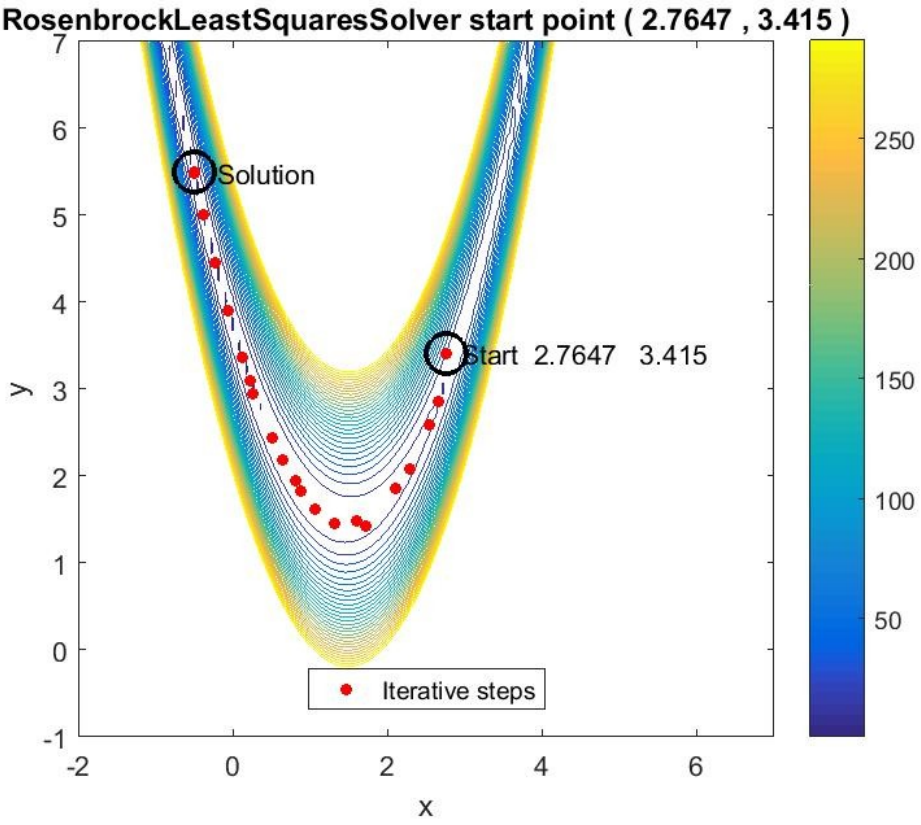

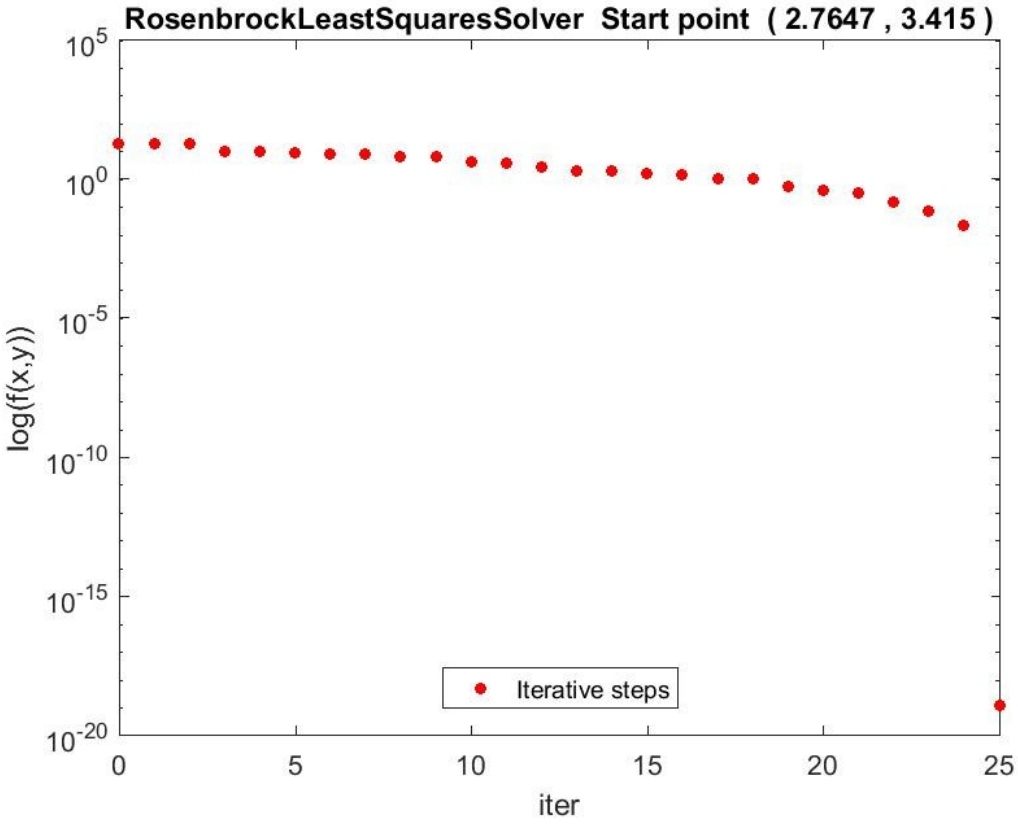

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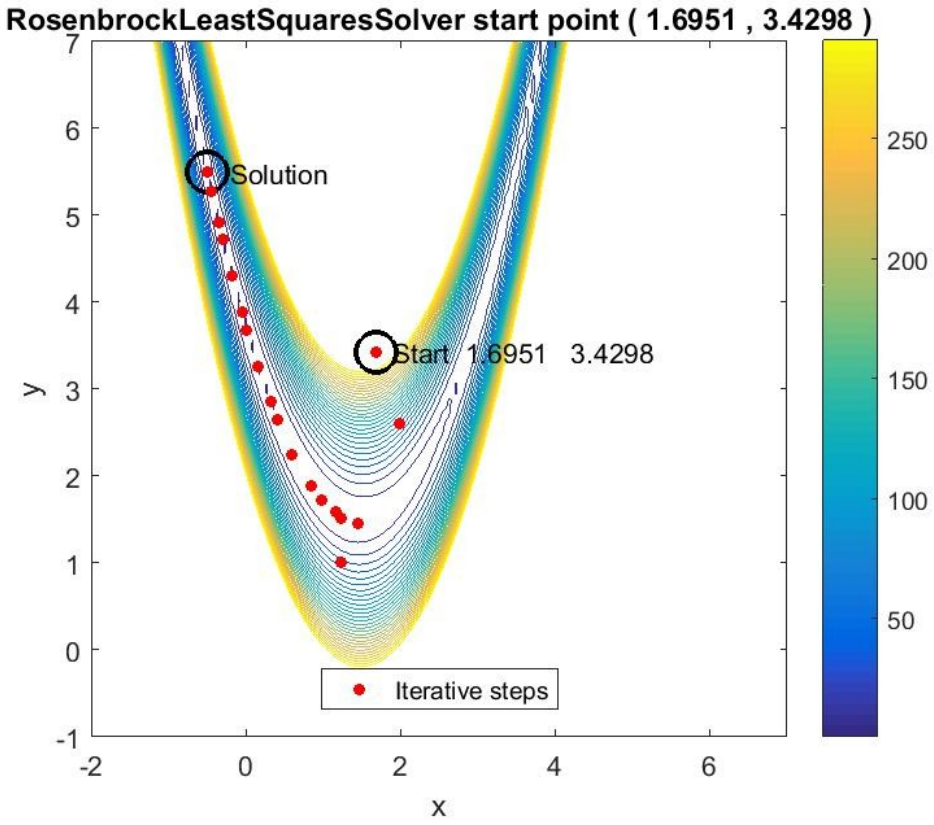

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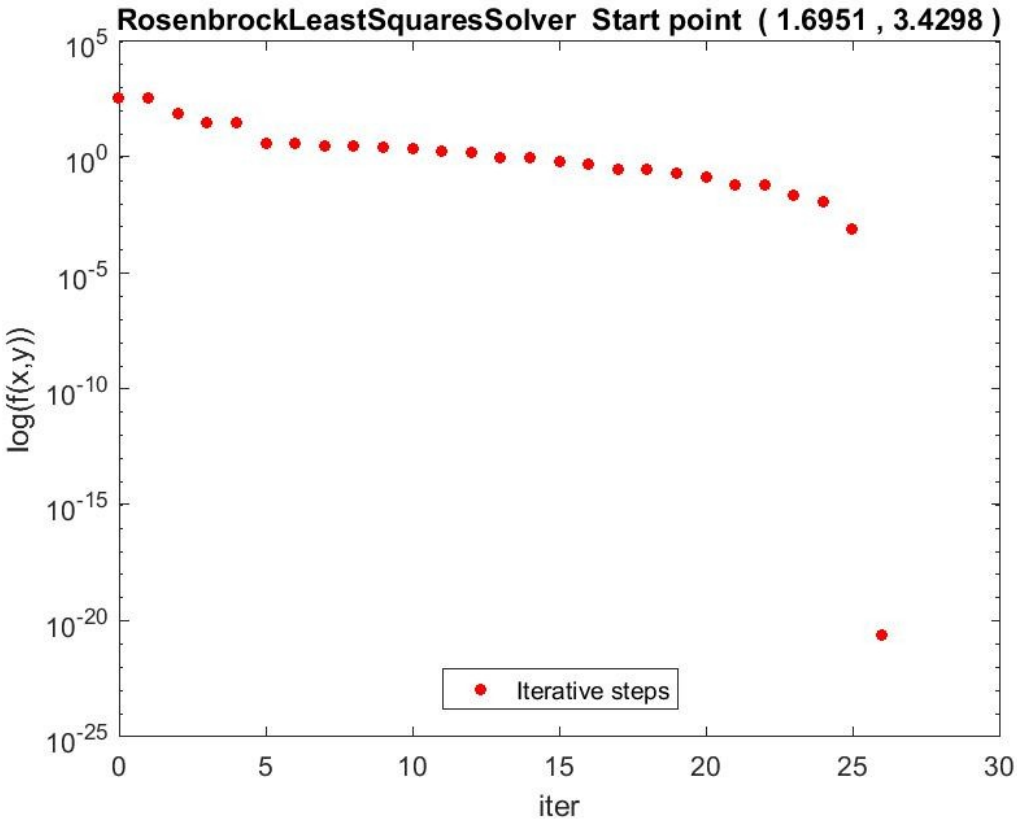

Conclusion:

The fastest method to minimise the Rosenbrock fuction was the least squares error, maybe because it is adpat to this problem. Acording to the other algorithms, the local search showed good outputs, but not as good as quasi newton method. In this last algorithm as much information we add (gradient, hessian, jacobian) the finding will be spend less iterations but more time per each iteration.

Moreover, I have to say that matlab is really useful and powerfull application, I was able to write a bunch of script using matlab tools, and show really good plots without spend a big efford.