

Lab6

May 18, 2022

1 Funkcje nieliniowe

1.1 Bartosz Kucharz

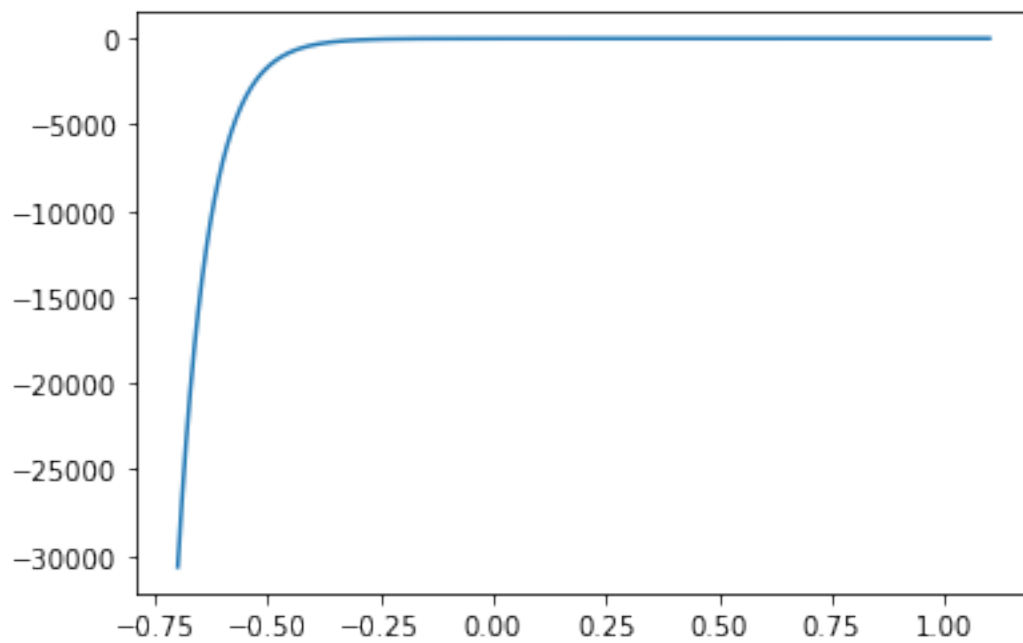
2 Zadanie 1

2.1 Zadana funkcja

$$f(x) = (x - 1)e^{-mx} + x^n$$

$$n = 12, m = 14, [-0.7, 1.1]$$

[<matplotlib.lines.Line2D at 0x7f4c985b75e0>]



3 Implementacja algorytmów wyznaczania pierwisatków równań nieliniowych

3.1 Kryteria stopu

3.1.1

$$\left| x^{(i+1)} - x^{(i)} \right| < \rho$$

3.2 Metoda siecznych

3.3 Metoda Newtona

4 Wyznaczanie pierwiastka

4.1 Wartość wyznaczona za pomocą silnika WolframAlpha

$$x \approx 0.51574856472875214594$$

4.2 Metoda siecznych

4.2.1 Kryterium stopu

$$\left| x^{(i+1)} - x^{(i)} \right| < \rho$$

Przy stałym a

Rho = 0.001

+-----+-----+-----+-----+-----+				
a	b	x0	iterations	
+-----+-----+-----+-----+-----+				
-0.7	1.1	0.5336936753747028	13	
-0.7	1.0	0.5240532041347802	12	
-0.7	0.9	0.5277512916266145	10	
-0.7	0.8	0.5285261761768484	8	
-0.7	0.7	0.5251826090075072	6	
-0.7	0.6	0.5332625359501886	3	
-0.7	0.5	0.5000000082903581	1	
-0.7	0.4	0.4936435812148215	3	
-0.7	0.3	0.48724452107392835	5	
-0.7	0.2	0.5091702872650163	8	
-0.7	0.1	0.5054590306299567	10	
-0.7	0.0	0.5013608331192829	12	
-0.7	-0.1	0.4970608311531688	14	
-0.7	-0.2	0.4927391730001689	16	
-0.7	-0.3	0.4886767505327251	18	
-0.7	-0.4	0.5115188333912458	21	
-0.7	-0.5	0.5113082989421035	23	
-0.7	-0.6	0.4903647023168099	24	

+-----+-----+-----+-----+-----+

Rho = 1e-05

+-----+-----+-----+-----+-----+				
a	b	x0	iterations	
+-----+-----+-----+-----+-----+				
-0.7	1.1	0.5157522702765323	16	
-0.7	1.0	0.5157486604889435	15	
-0.7	0.9	0.5157491028473451	13	
-0.7	0.8	0.5157492905643967	11	
-0.7	0.7	0.5157487414788464	9	
-0.7	0.6	0.5157510636085865	6	
-0.7	0.5	0.5157358059844588	3	
-0.7	0.4	0.5157484167818206	6	
-0.7	0.3	0.5157471753251637	8	
-0.7	0.2	0.5157450521316047	10	
-0.7	0.1	0.5157458328387577	12	
-0.7	0.0	0.515756507501372	14	
-0.7	-0.1	0.515748471014923	17	
-0.7	-0.2	0.5157481325675518	19	
-0.7	-0.3	0.5157474267184127	21	
-0.7	-0.4	0.515746606344873	23	
-0.7	-0.5	0.5157464482371467	25	
-0.7	-0.6	0.5157477718561783	27	
+-----+-----+-----+-----+-----+				

Rho = 1e-09

+-----+-----+-----+-----+-----+				
a	b	x0	iterations	
+-----+-----+-----+-----+-----+				
-0.7	1.1	0.5157485647287896	18	
-0.7	1.0	0.5157485647287522	17	
-0.7	0.9	0.5157485647287524	15	
-0.7	0.8	0.5157485647287526	13	
-0.7	0.7	0.5157485647287522	11	
-0.7	0.6	0.515748564728766	8	
-0.7	0.5	0.5157485647292999	5	
-0.7	0.4	0.5157485647287522	8	
-0.7	0.3	0.5157485647287546	10	
-0.7	0.2	0.5157485647287748	12	
-0.7	0.1	0.5157485647287595	14	
-0.7	0.0	0.5157485647286113	16	
-0.7	-0.1	0.5157485647287522	19	
-0.7	-0.2	0.5157485647287523	21	
-0.7	-0.3	0.5157485647287537	23	
-0.7	-0.4	0.515748564728758	25	

-0.7	-0.5	0.5157485647287592	27	
-0.7	-0.6	0.5157485647287527	29	

+-----+-----+-----+-----+

Przy stałym b

Rho = 0.001

a	b	x0	iterations
---	---	----	------------

+-----+-----+-----+-----+

-0.7	1.1	1.0998157507940247	1
-0.6	1.1	1.09925049224397	1
-0.5	1.1	0.5157517600067583	16
-0.4	1.1	0.5157504933262426	16
-0.3	1.1	0.515748737853972	16
-0.2	1.1	0.5157496293408209	14
-0.1	1.1	0.6040408175805133	2
0.0	1.1	0.5157800507872031	9
0.1	1.1	0.5157644871043251	11
0.2	1.1	0.5157484033428706	11
0.3	1.1	0.5157478539060875	9
0.4	1.1	0.4009773780524495	2
0.5	1.1	0.5000808733427737	2
0.6	1.1	0.5993367902144682	2
0.7	1.1	0.515748674525036	10
0.8	1.1	0.5157487332415227	12
0.9	1.1	0.515755204073494	13
1.0	1.1	0.5157626001611594	14

+-----+-----+-----+-----+

Rho = 1e-05

a	b	x0	iterations
---	---	----	------------

+-----+-----+-----+-----+

-0.7	1.1	0.5157485680042905	17
-0.6	1.1	0.5157485678541885	17
-0.5	1.1	0.5157485673059642	17
-0.4	1.1	0.515748565867055	17
-0.3	1.1	0.5157485647517418	17
-0.2	1.1	0.5157485651637929	15
-0.1	1.1	0.5157485698444311	8
0.0	1.1	0.5157485647211022	11
0.1	1.1	0.51574856472769	13
0.2	1.1	0.5157485647058241	12
0.3	1.1	0.5157485645108197	10

0.4	1.1	0.5157485647140905	8	
0.5	1.1	0.5157485647292914	6	
0.6	1.1	0.5157485662841673	8	
0.7	1.1	0.5157485647397264	11	
0.8	1.1	0.5157485647507518	13	
0.9	1.1	0.5157485731455411	14	
1.0	1.1	0.5157485647299743	16	
+-----+-----+-----+-----+				

Rho = 1e-09

a	b	x0	iterations	
+-----+-----+-----+-----+				
-0.7	1.1	0.5157485647287521	19	
-0.6	1.1	0.5157485647287522	19	
-0.5	1.1	0.5157485647287522	19	
-0.4	1.1	0.5157485647287522	19	
-0.3	1.1	0.5157485647287522	18	
-0.2	1.1	0.5157485647287536	16	
-0.1	1.1	0.5157485647287522	10	
0.0	1.1	0.5157485647287522	12	
0.1	1.1	0.5157485647287522	14	
0.2	1.1	0.5157485647287522	13	
0.3	1.1	0.5157485647287526	11	
0.4	1.1	0.5157485647287522	9	
0.5	1.1	0.5157485647287521	7	
0.6	1.1	0.5157485647287522	10	
0.7	1.1	0.5157485647287522	12	
0.8	1.1	0.5157485647287522	14	
0.9	1.1	0.5157485647287522	16	
1.0	1.1	0.5157485647287522	17	
+-----+-----+-----+-----+				

4.2.2 Kryterium stopu

$$|f(x^i)| < \rho$$

Przy stałym a

Rho = 0.001

a	b	x0	iterations	
+-----+-----+-----+-----+				
-0.7	1.1	0.5336936753747028	13	
-0.7	1.0	0.5240532041347802	12	

-0.7 0.9 0.5277512916266145 10
-0.7 0.8 0.5285261761768484 8
-0.7 0.7 0.5251826090075072 6
-0.7 0.6 0.5332625359501886 3
-0.7 0.5 0.5000000082903581 1
-0.7 0.4 0.4936435812148215 3
-0.7 0.3 0.48724452107392835 5
-0.7 0.2 0.5091702872650163 8
-0.7 0.1 0.5054590306299567 10
-0.7 0.0 0.5013608331192829 12
-0.7 -0.1 0.4970608311531688 14
-0.7 -0.2 0.4927391730001689 16
-0.7 -0.3 0.4886767505327251 18
-0.7 -0.4 0.5115188333912458 21
-0.7 -0.5 0.5113082989421035 23
-0.7 -0.6 0.4903647023168099 24
+-----+-----+-----+-----+

Rho = 1e-05

+-----+-----+-----+-----+
a b x0 iterations
+-----+-----+-----+-----+
-0.7 1.1 0.5157522702765323 16
-0.7 1.0 0.5157486604889435 15
-0.7 0.9 0.5157491028473451 13
-0.7 0.8 0.5157492905643967 11
-0.7 0.7 0.5157487414788464 9
-0.7 0.6 0.5157510636085865 6
-0.7 0.5 0.5157358059844588 3
-0.7 0.4 0.5157484167818206 6
-0.7 0.3 0.5157471753251637 8
-0.7 0.2 0.5157450521316047 10
-0.7 0.1 0.5157458328387577 12
-0.7 0.0 0.515756507501372 14
-0.7 -0.1 0.515748471014923 17
-0.7 -0.2 0.5157481325675518 19
-0.7 -0.3 0.5157474267184127 21
-0.7 -0.4 0.515746606344873 23
-0.7 -0.5 0.5157464482371467 25
-0.7 -0.6 0.5157477718561783 27
+-----+-----+-----+-----+

Rho = 1e-09

+-----+-----+-----+-----+
a b x0 iterations
+-----+-----+-----+-----+

-0.7 1.1 0.5157485647287896 18
-0.7 1.0 0.5157485647287522 17
-0.7 0.9 0.5157485647287524 15
-0.7 0.8 0.5157485647287526 13
-0.7 0.7 0.5157485647287522 11
-0.7 0.6 0.515748564728766 8
-0.7 0.5 0.5157485647292999 5
-0.7 0.4 0.5157485647287522 8
-0.7 0.3 0.5157485647287546 10
-0.7 0.2 0.5157485647287748 12
-0.7 0.1 0.5157485647287595 14
-0.7 0.0 0.5157485647286113 16
-0.7 -0.1 0.5157485647287522 19
-0.7 -0.2 0.5157485647287523 21
-0.7 -0.3 0.5157485647287537 23
-0.7 -0.4 0.515748564728758 25
-0.7 -0.5 0.5157485647287592 27
-0.7 -0.6 0.5157485647287527 29
+-----+-----+-----+-----+

Przy stałym b

Rho = 0.001

a		b	x0	iterations
-0.7	1.1	0.5336936753747028	13	
-0.6	1.1	0.5335869334378017	13	
-0.5	1.1	0.5331542995092017	13	
-0.4	1.1	0.5314282354072285	13	
-0.3	1.1	0.5251805903668469	13	
-0.2	1.1	0.5296019006369954	11	
-0.1	1.1	0.5356873245014612	4	
0.0	1.1	0.4975564631089038	7	
0.1	1.1	0.499763641964815	9	
0.2	1.1	0.4957017943749574	8	
0.3	1.1	0.49049381320668517	6	
0.4	1.1	0.49422744262619034	4	
0.5	1.1	1.1	0	
0.6	1.1	0.5329495219457052	4	
0.7	1.1	0.5242659649324006	7	
0.8	1.1	0.5251210756840555	9	
0.9	1.1	0.5359753819124653	10	
1.0	1.1	0.5392995584562438	11	

Rho = 1e-05

a	b	x0	iterations
-0.7	1.1	0.5157522702765323	16
-0.6	1.1	0.5157521644115423	16
-0.5	1.1	0.5157517600067583	16
-0.4	1.1	0.5157504933262426	16
-0.3	1.1	0.515748737853972	16
-0.2	1.1	0.5157496293408209	14
-0.1	1.1	0.5157533521793005	7
0.0	1.1	0.5157484859289295	10
0.1	1.1	0.5157644871043251	11
0.2	1.1	0.5157484033428706	11
0.3	1.1	0.5157478539060875	9
0.4	1.1	0.5157484462059775	7
0.5	1.1	0.515735885869007	4
0.6	1.1	0.515750855945509	7
0.7	1.1	0.515748674525036	10
0.8	1.1	0.5157487332415227	12
0.9	1.1	0.515755204073494	13
1.0	1.1	0.5157626001611594	14

Rho = 1e-09

a	b	x0	iterations
-0.7	1.1	0.5157485647287896	18
-0.6	1.1	0.5157485647287868	18
-0.5	1.1	0.5157485647287775	18
-0.4	1.1	0.5157485647287589	18
-0.3	1.1	0.5157485647287522	18
-0.2	1.1	0.5157485647287536	16
-0.1	1.1	0.5157485647288277	9
0.0	1.1	0.5157485647287522	12
0.1	1.1	0.51574856472769	13
0.2	1.1	0.5157485647287522	13
0.3	1.1	0.5157485647287526	11
0.4	1.1	0.5157485647287522	9
0.5	1.1	0.5157485647292914	6
0.6	1.1	0.5157485647287632	9
0.7	1.1	0.5157485647287522	12
0.8	1.1	0.5157485647287522	14
0.9	1.1	0.5157485647289244	15
1.0	1.1	0.5157485647299743	16

+-----+-----+-----+-----+-----+

4.3 Metoda Newtona

4.3.1 Kryterium stopu

$$\left| x^{(i+1)} - x^{(i)} \right| < \rho$$

Zaczynając od b

Rho = 0.001

+-----+-----+-----+-----+			
start x	x0	iterations	
+-----+-----+-----+-----+			
1.1	0.5157486902415126	11	
1.0	0.5157486104783698	10	
0.9	0.5157485685528187	9	
0.8	0.5157513564350305	7	
0.7	0.5157485795622319	6	
0.6	0.5157487186028589	4	
0.5	0.5157489518579742	2	
0.4	0.5157485952490433	4	
0.3	0.5157485697737031	5	
0.2	0.5157486447341296	7	
0.1	0.5157486425218536	8	
0.0	0.5157486592590539	10	
-0.1	0.5157486142209694	11	
-0.2	0.5157486376273693	13	
-0.3	0.5157485724569524	14	
-0.4	0.5157486037648755	16	
-0.5	0.5157487496753382	17	
-0.6	0.5157485786209821	19	
-0.7	0.5157489750735402	20	
+-----+-----+-----+-----+			

Rho = 1e-05

+-----+-----+-----+-----+			
start x	x0	iterations	
+-----+-----+-----+-----+			
1.1	0.5157485647288007	12	
1.0	0.5157485647287586	11	
0.9	0.5157485647287522	10	
0.8	0.5157485647527724	8	
0.7	0.5157485647287529	7	
0.6	0.5157485647288251	5	

0.5	0.515748564729214	3	
0.4	0.515748564728755	5	
0.3	0.5157485647287522	6	
0.2	0.5157485647287718	8	
0.1	0.5157485647287708	9	
0.0	0.5157485647287797	11	
-0.1	0.5157485647287597	12	
-0.2	0.5157485647287685	14	
-0.3	0.5157485647287523	15	
-0.4	0.5157485647287569	17	
-0.5	0.5157485647288576	18	
-0.6	0.5157485647287527	20	
-0.7	0.5157485647292711	21	
+-----+			

Rho = 1e-09

start x	x0	iterations	
1.1	0.5157485647287522	13	
1.0	0.5157485647287522	12	
0.9	0.5157485647287522	11	
0.8	0.5157485647287522	9	
0.7	0.5157485647287522	8	
0.6	0.5157485647287521	6	
0.5	0.5157485647287522	4	
0.4	0.5157485647287522	6	
0.3	0.5157485647287522	7	
0.2	0.5157485647287521	9	
0.1	0.5157485647287522	10	
0.0	0.5157485647287522	12	
-0.1	0.5157485647287522	13	
-0.2	0.5157485647287522	15	
-0.3	0.5157485647287522	16	
-0.4	0.5157485647287522	18	
-0.5	0.5157485647287522	19	
-0.6	0.5157485647287522	21	
-0.7	0.5157485647287522	22	
+-----+			

Zaczynając od a

Rho = 0.001

start x	x0	iterations	
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+-----+			
	-0.7	0.5157489750735402	20
	-0.6	0.5157485786209821	19
	-0.5	0.5157487496753382	17
	-0.4	0.5157486037648755	16
	-0.3	0.5157485724569524	14
	-0.2	0.5157486376273693	13
	-0.1	0.5157486142209694	11
	0.0	0.5157486592590539	10
	0.1	0.5157486425218536	8
	0.2	0.5157486447341296	7
	0.3	0.5157485697737031	5
	0.4	0.5157485952490433	4
	0.5	0.5157489518579742	2
	0.6	0.5157487186028589	4
	0.7	0.5157485795622319	6
	0.8	0.5157513564350305	7
	0.9	0.5157485685528187	9
	1.0	0.5157486104783698	10
	1.1	0.5157486902415126	11
+-----+			

Rho = 1e-05

+-----+			
	start x	x0	iterations
+-----+			
	-0.7	0.5157485647292711	21
	-0.6	0.5157485647287527	20
	-0.5	0.5157485647288576	18
	-0.4	0.5157485647287569	17
	-0.3	0.5157485647287523	15
	-0.2	0.5157485647287685	14
	-0.1	0.5157485647287597	12
	0.0	0.5157485647287797	11
	0.1	0.5157485647287708	9
	0.2	0.5157485647287718	8
	0.3	0.5157485647287522	6
	0.4	0.515748564728755	5
	0.5	0.515748564729214	3
	0.6	0.5157485647288251	5
	0.7	0.5157485647287529	7
	0.8	0.5157485647527724	8
	0.9	0.5157485647287522	10
	1.0	0.5157485647287586	11
	1.1	0.5157485647288007	12
+-----+			

Rho = 1e-09

start x	x0	iterations
-0.7	0.5157485647287522	22
-0.6	0.5157485647287522	21
-0.5	0.5157485647287522	19
-0.4	0.5157485647287522	18
-0.3	0.5157485647287522	16
-0.2	0.5157485647287522	15
-0.1	0.5157485647287522	13
0.0	0.5157485647287522	12
0.1	0.5157485647287522	10
0.2	0.5157485647287521	9
0.3	0.5157485647287522	7
0.4	0.5157485647287522	6
0.5	0.5157485647287522	4
0.6	0.5157485647287521	6
0.7	0.5157485647287522	8
0.8	0.5157485647287522	9
0.9	0.5157485647287522	11
1.0	0.5157485647287522	12
1.1	0.5157485647287522	13

4.3.2 Kryterium stopu

$$|f(x^i)| < \rho$$

Zaczynając od b

Rho = 0.001

start x	x0	iterations
1.1	0.5230821520470125	9
1.0	0.5215516862206299	8
0.9	0.5189744129513688	7
0.8	0.5305130099982345	5
0.7	0.5202026016710752	4
0.6	0.523434159208395	2
0.5	0.5161010660373018	1
0.4	0.5093663465654541	2
0.3	0.5157889994675341	4
0.2	0.5072261093054499	5

	0.1		0.5155892878309475		7	
	0.0		0.5067627354551995		8	
	-0.1		0.5156215861343247		10	
	-0.2		0.5074701709872498		11	
	-0.3		0.515798602789125		13	
	-0.4		0.508891630232791		14	
	-0.5		0.5159926153511188		16	
	-0.6		0.5106420232414604		17	
	-0.7		0.5161114240320801		19	
+-----+						

Rho = 1e-05

+-----+						
	start x		x0		iterations	
+-----+						
	1.1		0.5157486902415126		11	
	1.0		0.5157486104783698		10	
	0.9		0.5157485685528187		9	
	0.8		0.5157485647527724		8	
	0.7		0.5157485795622319		6	
	0.6		0.5157487186028589		4	
	0.5		0.5157489518579742		2	
	0.4		0.5157485952490433		4	
	0.3		0.5157485697737031		5	
	0.2		0.5157486447341296		7	
	0.1		0.5157486425218536		8	
	0.0		0.5157486592590539		10	
	-0.1		0.5157486142209694		11	
	-0.2		0.5157486376273693		13	
	-0.3		0.5157485724569524		14	
	-0.4		0.5157486037648755		16	
	-0.5		0.5157487496753382		17	
	-0.6		0.5157485786209821		19	
	-0.7		0.5157489750735402		20	
+-----+						

Rho = 1e-09

+-----+						
	start x		x0		iterations	
+-----+						
	1.1		0.5157485647287522		13	
	1.0		0.5157485647287586		11	
	0.9		0.5157485647287522		10	
	0.8		0.5157485647287522		9	
	0.7		0.5157485647287529		7	
	0.6		0.5157485647287521		6	

0.5	0.5157485647287522	4	
0.4	0.515748564728755	5	
0.3	0.5157485647287522	6	
0.2	0.5157485647287521	9	
0.1	0.5157485647287522	10	
0.0	0.5157485647287522	12	
-0.1	0.5157485647287597	12	
-0.2	0.5157485647287522	15	
-0.3	0.5157485647287523	15	
-0.4	0.5157485647287569	17	
-0.5	0.5157485647287522	19	
-0.6	0.5157485647287527	20	
-0.7	0.5157485647287522	22	
+-----+			

Zaczynając od a

Rho = 0.001

+-----+			
start x	x0	iterations	
+-----+			
-0.7	0.5161114240320801	19	
-0.6	0.5106420232414604	17	
-0.5	0.5159926153511188	16	
-0.4	0.508891630232791	14	
-0.3	0.515798602789125	13	
-0.2	0.5074701709872498	11	
-0.1	0.5156215861343247	10	
0.0	0.5067627354551995	8	
0.1	0.5155892878309475	7	
0.2	0.5072261093054499	5	
0.3	0.5157889994675341	4	
0.4	0.5093663465654541	2	
0.5	0.5161010660373018	1	
0.6	0.523434159208395	2	
0.7	0.5202026016710752	4	
0.8	0.5305130099982345	5	
0.9	0.5189744129513688	7	
1.0	0.5215516862206299	8	
1.1	0.5230821520470125	9	
+-----+			

Rho = 1e-05

+-----+			
start x	x0	iterations	

+-----+			
	-0.7	0.5157489750735402	20
	-0.6	0.5157485786209821	19
	-0.5	0.5157487496753382	17
	-0.4	0.5157486037648755	16
	-0.3	0.5157485724569524	14
	-0.2	0.5157486376273693	13
	-0.1	0.5157486142209694	11
	0.0	0.5157486592590539	10
	0.1	0.5157486425218536	8
	0.2	0.5157486447341296	7
	0.3	0.5157485697737031	5
	0.4	0.5157485952490433	4
	0.5	0.5157489518579742	2
	0.6	0.5157487186028589	4
	0.7	0.5157485795622319	6
	0.8	0.5157485647527724	8
	0.9	0.5157485685528187	9
	1.0	0.5157486104783698	10
	1.1	0.5157486902415126	11
+-----+			

Rho = 1e-09

+-----+			
	start x	x0	iterations
+-----+			
	-0.7	0.5157485647287522	22
	-0.6	0.5157485647287527	20
	-0.5	0.5157485647287522	19
	-0.4	0.5157485647287569	17
	-0.3	0.5157485647287523	15
	-0.2	0.5157485647287522	15
	-0.1	0.5157485647287597	12
	0.0	0.5157485647287522	12
	0.1	0.5157485647287522	10
	0.2	0.5157485647287521	9
	0.3	0.5157485647287522	6
	0.4	0.515748564728755	5
	0.5	0.5157485647287522	4
	0.6	0.5157485647287521	6
	0.7	0.5157485647287529	7
	0.8	0.5157485647287522	9
	0.9	0.5157485647287522	10
	1.0	0.5157485647287586	11
	1.1	0.5157485647287522	13
+-----+			

5 Zadanie 2

Rozwiąż układ równań metodą Newtona

5.1 Zadany układ równań

$$x_1^2 + x_2^2 + x_3 = 12x_1^2 - x_2^2 - 4x_3^2 = -3x_1^2 + x_2 + x_3 = 1$$

5.1.1 Metoda równań Newtona

5.1.2 Kryterium stopu

$$|f(x^i)| < \rho$$

Rozwiązanie	Wektor początkowy
[-1.54779 -0. -1.39564]	[-0.76238511 -0.20233794 -1.83138492]
[-1. 1. -1.]	[-0.71957548 0.68463106 -0.60686896]
[-0.32304 0. 0.89564]	[-1.87731093 -1.12474311 -0.20606026]
[0.32304 0. 0.89564]	[0.67016256 0.10093349 1.71007973]
[1. 1. -1.]	[0.45267599 1.78501596 -0.29032458]
[1.54779 -0. -1.39564]	[0.59915489 -2.0711804 -0.85502025]

Rozwiązanie	Wektor początkowy
[-1.54779 0. -1.39564]	[-0.3340507 -0.01228922 -1.07811543]
[-1. 1. -1.]	[-0.96288278 2.14522739 -0.63507119]
[-0.32304 0. 0.89564]	[-1.25902663 -0.6352942 1.98764629]
[0.32304 -0. 0.89564]	[2.05985123 -1.93608014 2.07527497]
[1. 1. -1.]	[0.41210983 1.21219292 -1.56812942]
[1.54779 -0. -1.39564]	[1.29220053 0.07706622 -0.63191262]

Rozwiązanie	Wektor początkowy
[-1.54779 -0. -1.39564]	[-0.55018106 -0.25200834 -0.66229715]
[-1. 1. -1.]	[-0.46833765 1.15108251 -1.04037309]
[-0.32304 -0. 0.89564]	[0.03252615 -0.25607117 1.67145238]
[0.32304 -0. 0.89564]	[1.0409982 -1.08070775 0.54070671]
[1. 1. -1.]	[1.23706324 0.92571387 -1.16643184]
[1.54779 -0. -1.39564]	[1.07662514 -1.60720526 -1.74457006]

Wektory początkowe dla których metoda nie jest zbieżna

[-0.55018106 -0.25200834 -0.66229715]

	[-0.76109071	0.40408074	-0.40260101]	
	[1.07662514	-1.60720526	-1.74457006]	
	[0.03252615	-0.25607117	1.67145238]	
	[-0.19445902	-0.06286381	-0.87546553]	
	[-1.09866684	0.21083651	0.67756631]	
	[1.95733661	-2.0734741	-0.93641315]	
	[-0.05269349	-0.98331608	1.53495382]	
	[-0.73209104	-0.18496119	-0.51230741]	
	[1.23706324	0.92571387	-1.16643184]	
	[-1.39900774	0.06243313	0.16481058]	
	[1.0409982	-1.08070775	0.54070671]	
	[-1.36039575	0.04757098	0.24816548]	
	[1.01947702	-2.0326752	1.11355923]	
	[-1.44390377	-0.4633318	0.85362145]	
	[0.2130565	0.04477822	-0.23336265]	
	[-0.00480793	-1.36181252	0.0997619]	
	[-0.44712951	-2.75361687	0.1509647]	
	[-1.18043679	-0.26034693	2.03795988]	
	[-0.37940296	0.08191493	-0.4995591]	
	[-0.83825347	-0.64016636	-0.5846376]	
	[0.85983271	-0.81324658	-1.57260041]	
	[2.51997961	-0.5766493	1.33738672]	
	[0.48299878	-0.00820353	0.12327066]	
	[-1.24158394	0.03682051	-0.55317293]	
	[0.6268231	-0.79972474	-0.50389299]	
	[0.92590259	-0.24669794	-0.70445595]	
	[0.36166089	-0.993527	0.69464166]	
	[0.43027728	0.98356112	-1.04561059]	
	[0.42847851	-1.56183075	1.01595436]	
	[-0.46833765	1.15108251	-1.04037309]	
	[-0.27066708	0.40103082	-0.41200157]	
	[-1.01623553	-0.37620581	-1.39073581]	
	[0.27483762	-1.29084848	-1.0904637]	
	[-0.16066091	-1.09265754	0.28070508]	
	[-0.15848796	-0.57154414	-1.23778716]	
	[-1.33011205	-0.1660578	1.56830842]	
	[-0.80586077	0.28561709	0.1765756]	
	[-0.365973	-0.03530746	-0.50570374]	
	[0.08706169	-0.13827546	-2.13181872]	
	[-0.17632135	-1.04378263	-1.46291134]	
	[-0.31915145	-0.96947537	0.35403726]	
	[-1.62500414	-0.69083148	-0.67355627]	
	[-0.48041131	-0.86255299	-1.0122499]	
+-----+				

5.1.3 Kryterium stopu

$$\left| x^{(i+1)} - x^{(i)} \right| < \rho$$

Rozwiązanie			Wektor początkowy		
[-1.54779	0.	-1.39564]	[-0.4338453	-0.61019545	-0.84164839]
[-1.	1.	-1.]	[-1.46919058	0.55469841	0.16704534]
[-0.32304	0.	0.89564]	[0.58423436	-0.7493927	-0.17666176]
[0.32304	-0.	0.89564]	[1.40443192	-1.21977856	1.46405804]
[1.	1.	-1.]	[0.68459659	0.63462293	-0.63087872]
[1.54779	0.	-1.39564]	[0.76580798	-0.18878367	-0.77704763]
Rozwiązanie			Wektor początkowy		
[-1.54779	-0.	-1.39564]	[-0.49739495	0.31942913	-1.37892026]
[-1.	1.	-1.]	[-1.5658208	0.90559742	-1.15430372]
[-0.32304	0.	0.89564]	[-0.45216086	-0.09016138	1.0168858]]
[0.32304	0.	0.89564]	[0.78390043	-0.27773502	0.07686019]
[1.	1.	-1.]	[0.00317266	0.80548671	-0.42179195]
[1.54779	0.	-1.39564]	[0.40992184	0.15424314	-1.49420893]
Rozwiązanie			Wektor początkowy		
[-1.54779	-0.	-1.39564]	[-0.10170271	-0.21151856	-0.46423031]
[-1.	1.	-1.]	[-0.76176299	1.28382025	-0.69873233]
[-0.32304	0.	0.89564]	[-0.09577643	-1.22168286	0.50473022]
[0.32304	-0.	0.89564]	[0.59256274	-0.35883149	0.88268577]
[1.54779	-0.	-1.39564]	[0.23320078	-1.28380089	-0.8521647]]
Wektory początkowe dla których metoda nie jest zbieżna					
[0.23320078	-1.28380089	-0.8521647]			
[-0.10170271	-0.21151856	-0.46423031]			
[-0.09577643	-1.22168286	0.50473022]			
[-1.18412467	-2.35564174	0.47095433]			
[-1.36179639	-0.56759182	-0.81922401]			
[0.21746956	-1.01342955	-0.54540371]			
[0.59256274	-0.35883149	0.88268577]			
[0.30141811	0.01213966	-1.64047857]			
[-0.27948617	-0.69361642	1.13618279]			
[1.49827235	-0.28015821	-0.80724557]			
[-0.50772808	0.31795692	1.37339233]			

	[1.844503	-0.06864857	-1.12489736]	
	[-0.76176299	1.28382025	-0.69873233]	
	[-0.5000018	-0.21066308	-0.06742963]	
	[0.2967698	-1.11331774	-1.10917318]	
	[-2.06701771	-0.14263285	1.01222769]	
	[-0.534012	0.35625858	-0.90403364]	
	[0.2206416	-2.23292564	1.28637474]	
	[-1.55735004	-0.50641242	0.23215014]	
	[-0.8152151	0.54387304	-0.11064331]	
	[-0.56858739	-0.35931127	0.81226276]	
	[0.18579301	0.59958663	-0.58390849]	
	[-0.82077333	-0.50669564	-0.43382336]	
	[-0.95049399	0.05178847	-1.43540553]	
	[-0.47273663	-2.46225625	0.63458466]	
	[-0.90666434	0.01098712	-0.28069356]	
	[1.03478716	-0.30652793	-0.42249834]	
	[-1.06015184	0.09238432	1.32926141]	
	[0.85602248	0.48975925	-0.41618551]	
	[-0.43228665	0.14993979	0.52741519]	
	[2.30548523	-0.45933412	-0.60467962]	
	[1.5903475	0.20495943	-0.6462161]	
	[1.33668542	0.24564019	2.73894846]	
	[-0.32008728	0.07653934	0.30144304]	
	[-0.91641787	0.05648928	-1.34687295]	
	[0.89503488	-0.88066606	-0.65979899]	
	[0.71142257	0.5395827	1.28500483]	
	[-0.06259376	-0.50483345	0.92655824]	
	[-1.23336717	1.58021682	-1.24965608]	
	[0.50639574	-0.15738588	-0.98757994]	
	[0.58011153	-0.14706915	1.85087468]	
+-----+				

Do wykrycia wszystkich rozwiązań powtórzono metodę 100 krotnie przyjmując za wektory początkowe z wartości z rozkładu normalnego. W wyniku czego otrzymano 6 rozwiązań układu równań.