2 作业

Using a steepest-descent method with update formula:

$$x_{k+1} = x_k - \frac{\nabla f(x_k)}{||\nabla f(x_k)||}$$

find the minimum of the quadratic function

$$f(x_1, x_2) = (x_1 - 2)^2 + 4(x_2 - 3)^2$$

starting from $x_0 = [0, 0]^T$.Using Matlab, plot the algorithmic moves(x_k as function of k) and **verify the zigzag property of the algorithm**.**What optimization methods can be used to solve this zigzag phenomenon? How?**

Steepest-descent method

迭代次数	x_k^T	$f(x_k)$	$\nabla f(x_k^T)$	$\nabla f(x_k^T)_{norm}$
0	(0, 0)	40.0000	(−4.0000, −24.0000)	24.3311
1	(0.1644, 0.9864)	19.5879	(−3.6712, −16.1088)	16.5219
2	(0.3866, 1.9614)	6.9179	(−3.2268, −8.3088)	8.9134
3	(0.7486, 2.8936)	1.6113	(−2.5028, −0.8515)	2.6436
4	(1.6953, 3.2156)	0.2788	(−0.6093, 1.7252)	1.8296
5	(2.0284, 2.2727)	2.1165	(0.0567, −5.8181)	5.8184
6	(2.0186, 3.2727)	0.2978	(0.0372, 2.1815)	2.1818
7	(2.0016, 2.2728)	2.1151	(0.0031, −5.8173)	5.8173
8	(2.0010, 3.2728)	0.2978	(0.0020, 2.1827)	2.1827
9	(2.0001, 2.2728)	2.1151	(0.0002, −5.8173)	5.8173
10	(2.0001, 3.2728)	0.2978	(0.0001, 2.1827)	2.1827

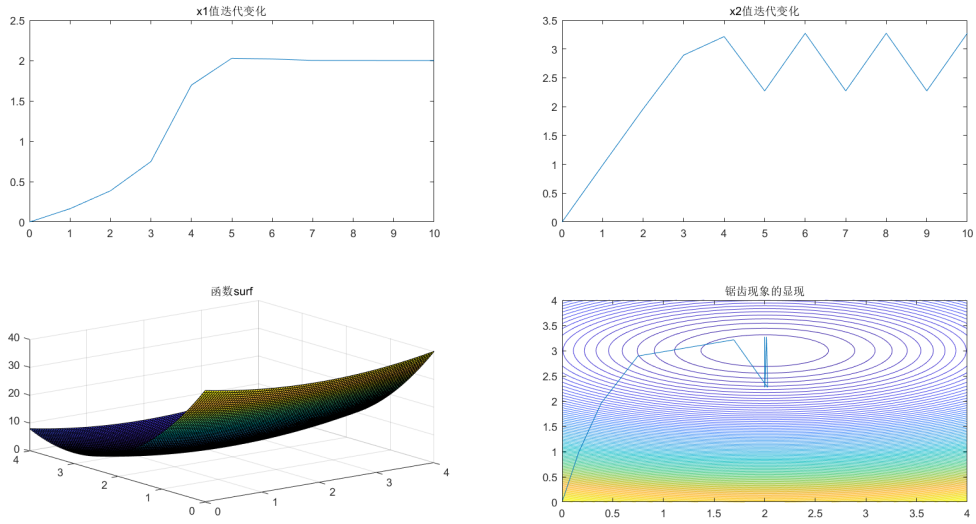

图 1: 函数迭代

共轭梯度法，选择共轭方向，共轭方向搜索可以避免锯齿现象，应用的函数是：Fletcher-Reeves 共轭梯度法，构造下一个搜索方向 $d^{(k+1)} = -g_{k+1} + \beta_k d^{(k)}$，这样更新可以修正迭代的方向，以解决锯齿现象。