Instructions for code running

All computer codes used in this article can be found online at https://github.com/zqh769282927692/CBCA-code. The codes can be used as follows.

(1) Download all files and place them together in a folder.

(2) There are two *vfproj* files: *B3dc_sep_Cur.vfproj* and *B3dcDraw_Cur.vfproj*. The former is used for analysis and the latter for plotting. Open them using Visual Studio 2010.

(3) First, run B3dc_sep_Cur.vfproj. This project includes *B3DC_sep_Cur.for*, *Trace_cur.for*, and *Cal_Geometry.for*, as well as *DelaunaryDLL.lib*, *DelaunaryDLL.dll*. These files will be loaded automatically when opening this project. Two file names of input data files, *6mian12.dat*, and *CurSufInp56.txt*, are put in *Inpt_B3DC.DAT*. When running, the program will load *Inpt_B3DC.DAT* and then load the input data. The meanings of the input data in these files are labeled briefly in the files, as shown in Appendix 1, 2, and 3.

(4) Then, run *B3dcDraw_Cur.vfproj*. This project includes *B3DCdraw_Cur.for*. Its corresponding input data file is *Inpt_B3DC_Draw.DAT*.

(5) Finally, a file named BLKCUT3D.DXF is generated. You can open it using AUTOCAD, as shown in Fig.1. It is exactly Fig. 8 in the article. If the input data are changed, different analysis results will be obtained. Besides, the analysis results are presented in *B3dcDATA.dat* and *B3dcVol.dat*.

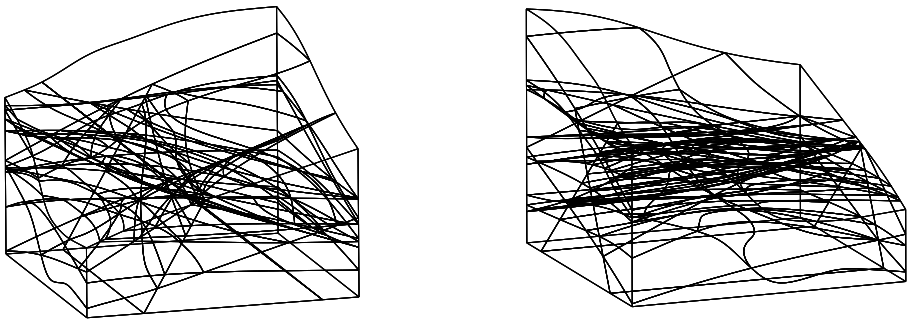

Fig.1 The example of code runing.

Appendix 1: Input data in *CurSufInp56.txt*

```
12                                  'There are 12 surfaces.
27  4                               'There are 27 points defining the first surface. Among them,
                                    ' the first 4 points delineate the boundary of this surface.
-10 -2    70                        'The coordinates of the first point
130       -2    30                  'The coordinates of the second point
130       130   65
-10 130   100
-10 19    75
-10 28    80
-10 36    85
-10 53.3  90
-10 70    95
20  7     65
20  25    75
20  60    85
20  80    91
40  3.4   55
40  18.3  60
40  46.2  70
40  76.8  80
40  100   87
60  9.5   40
60  15.9  50
60  50    60
60  82    70
90  8     33
90  18    40
90  45.4  50
90  80    60
90  98    65

27  4                               'Definition of the second surface
-10 -2    40
130       -2    2.0
130       130   35
-10 130   70
-10 19    45
-10 28    50
-10 36    55
-10 53.3  60
-10 70    65
20  7     35
```

20 25   45
20 60   55
20 80   61
40 3.4   25
40 18.3 30
40 46.2 40
40 76.8 50
40 100 57
60 9.5   10
60 15.9 20
60 50   30
60 82   40
90 8   10
90 18   10
90 45.4 20
90 80   30
90 98   35

6   4
-10 -10   52.5
130 -10   52
130 130   21
-10 130   30
40   -10 60
55 45   55.5

6   4
-10   -10   32.5
130   -10   34
130 130   30
-10 130   35
40   10   44
35 45   43.5

 6   4
 -10   -10   16.5
130   -10   12
130 130   10
-10 130   15
40   10 32
35 45   25.5

8   4
 -10   -10   66.5

130 -10 62
130 130 40
-10 130 65
40 10 59
35 45 58
60 50 53
55 55 57.5

8 4
-10 -10 37.5
130 -10 33
130 130 24
-10 130 19
40 10 38
35 45 33
60 50 30
55 55 28

5 4
-10 -10 76.3
130 -10 71
130 130 41
-10 130 43
60 50 56

5 4
-10 -10 65.3
130 -10 32
130 130 29.5
-10 130 69.8
60 50 46

5 4
-10 -10 35.3
130 -10 35.9
130 130 79.5
-10 130 89.8
60 50 66.8

5 4
-10 -10 -5.3
130 -10 15.9
130 130 89.5
-10 130 39.8

60 50 36.8

5 4
-10 -10 63
130 -10 79
130 130 19.5
-10 130 9.8
60 50 38

15 2.4 ! The maximum length of triangles of slave surface, the length of step
0 !Triangulate the surfaces using Delaunary or not. 0 means no and 1 means yes.
4 8 ! Two control parameters of delaunary.

Appendix 2: Input data in *6mian12.dat*

```
1                                   ‘ Frequency of program running
90                                  ‘ Direction of the X axis.
-15.0 -15.0 -15.0                   ‘ Domain of the stochastic fracture network simulation.
135.0 -15.0 -15.0
135.0 135.0 -15.0
-15.0 135.0 -15.0
-15.0 -15.0 95.0
135.0 -15.0 95.0
135.0 135.0 95.0
-15.0 135.0 95.0
1                                   ‘ Slope analysis
0                                   ‘The number of excavation faces on the boundary

1   0    0      ‘ The number denoting on or under the boundary surface 1, Dip, Dip direction
0   0    0
1   90 270
1   90 90
1   90   0
1   90   180
0                                   ‘ There is no concave area
0                                   ‘ The quantity of stochastic joint groups
0                                   ‘ The quantity of parallel formations
0                                   ‘The quantity of determinate circular fractures

2                                   ‘ The quantity of determinate rectangular fractures
60 180   4                          'Definition of the first fractures
-4   80 95
124 80 95
124   10 -5
-4      10 -5

40   0   4                          'Definition of the second fractures
-4   5   83
124   5   83
124   101 -28
-4   101 -28

0     0.2
0
1       1
0.6
```

1 ! Is the surfaces considered? “1” denotes yes.

1 ! The supplementary surface is used as the boundary surface, “1” denotes yes.

1 1 ! The blocks which are located above or below the surface are retained (“1” denotes that the below are retained), the number of the supplementary surface.

Appendix 3: Input data in *Inpt_B3DC_Draw.DAT*

```
y               ‘ Whether or not generate the figures in the dxf format. “y” means yes.
0               ‘ The number of the block which will be output. If “0” is input, all blocks
                    will be output.
12              ‘The number of face which will be displayed. For debugging the code,
                ‘ it is more convenient to draw the intersection lines in a specified surface
                ‘ and then find the problem that needs to be solved.
```