

## BASIC MANUAL TO WORK WITH CGX

This is a document where it is explained in simple way how to build some simple geometries in Calculix. First we start giving a short information about the installation of Calculix; for that do the following:

(1) Go to <http://www.bconverged.com/download.php> and select the option download.

(2) In that page you will find the file [CalculiX\\_2\\_2\\_win\\_002.zip](#). Click on it and download; if you want you can save the file, otherwise you can open the folder and click on the .exe file that you find inside. Once you click on the .exe file the program will install as any program.

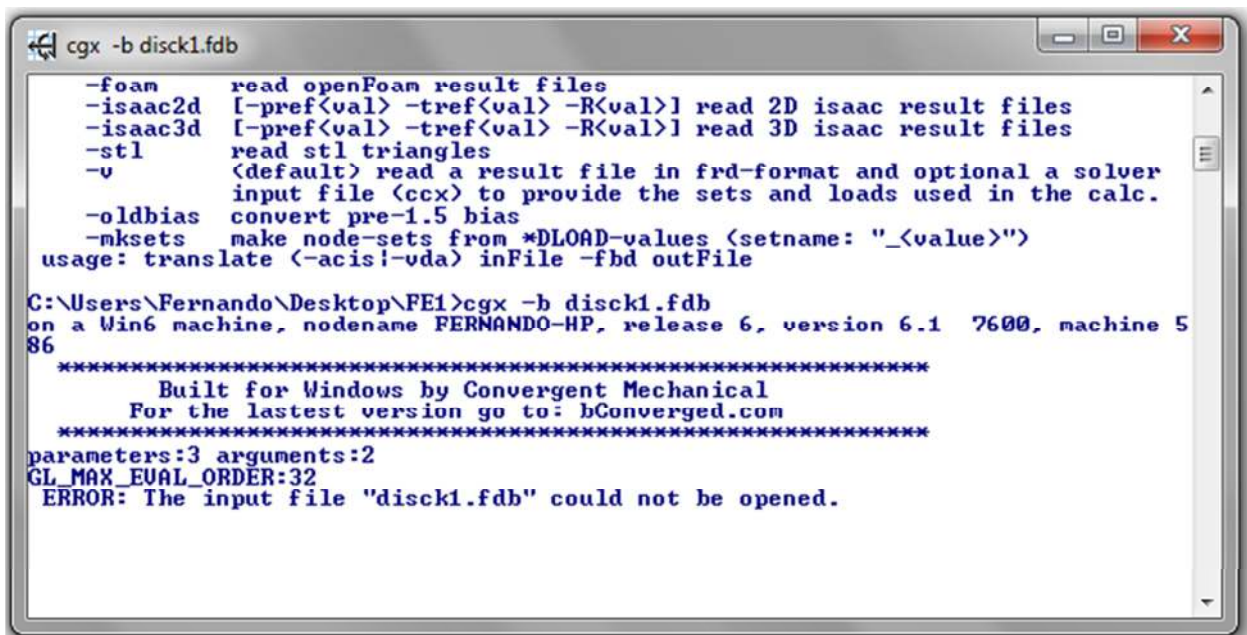
(3) In the page [www.dhondt.de](http://www.dhondt.de) you will find some examples and some information about the program; there you will find the user's manual too. If you have problems opening the user's manual from that page, do not waste your time, go to the page:

[http://web.mit.edu/calculix\\_v2.0/CalculiX/cgx\\_2.0/doc/cgx/index.html](http://web.mit.edu/calculix_v2.0/CalculiX/cgx_2.0/doc/cgx/index.html)

There you can open the manual easily.

### TO CREATE A NEW FILE:

(1) Open cgx going to **Begin > all programs > bConverged**; there you will find a folder called Calculix; make click there and then click Calculix Command. By doing this you are opening cgx; you should be able to see the following window commands.



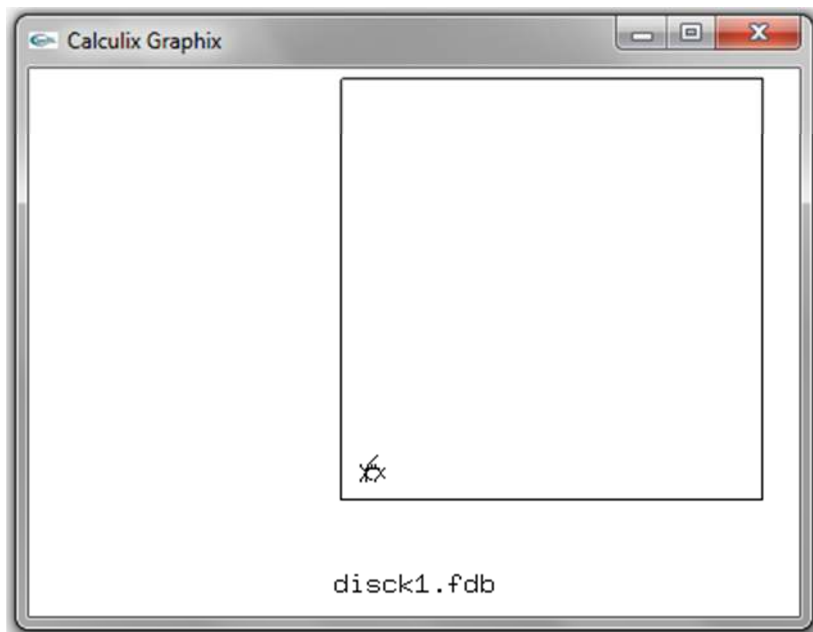
```
cgx -b disk1.fdb
-foam      read openFoam result files
-isaac2d   [-pref<val> -tref<val> -R<val>] read 2D isaac result files
-isaac3d   [-pref<val> -tref<val> -R<val>] read 3D isaac result files
-stl       read stl triangles
-v         <default> read a result file in frd-format and optional a solver
           input file (ccx) to provide the sets and loads used in the calc.
-oldbias   convert pre-1.5 bias
-mksets    make node-sets from *DLOAD-values (setname: "_<value>")
usage: translate [-acis!-vda] inFile -fbd outFile

C:\Users\Fernando\Desktop\FE1>cgx -b disk1.fdb
on a Win6 machine, nodename FERNANDO-HP, release 6, version 6.1 7600, machine 5
86
*****
      Built for Windows by Convergent Mechanical
      For the latest version go to: bConverged.com
*****
parameters:3 arguments:2
GL_MAX_EVAL_ORDER:32
ERROR: The input file "disk1.fdb" could not be opened.
```

(2) In that window command, write the following; `cgx -b namefile.fdb` where *namefile* is the name that you want to give to your file. The draw window with the name that you just gave, should appear (see figure below)

Now you are ready to create the geometry to be analyzed.

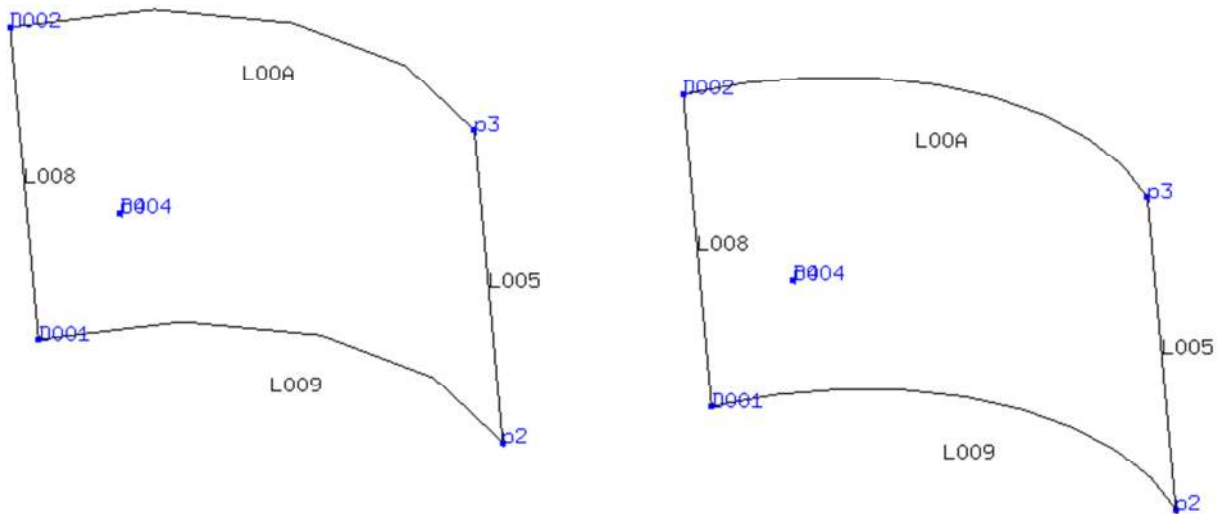
NOTE. TO BE ABLE TO WRITE ANY COMMAND IN THE COMMAND WINDOW, THE MOUSE POINTER SHOULD BE PLACED ON THE DRAW WINDOW. REMEMBER SAVE FREQUENTLY THE GEOMETRY BY TYPING `SAVE ENTER`



## CREATE A CYLINDER

To create a simple cylinder you can follow the following steps:

- (1) Create a point with coordinates (0, 0, 0). For that give the following command *pnt p1 0 0 0*, then press ENTER; in the last command, *pnt* is the command used to create a point, *p1* is the name given to that point (you can give whatever name you want) and *0 0 0* are the coordinates.
- (2) In the same way create three more points with coordinates *1 0 0*, *1 0 1*, and *0 0 1*.
- (3) Now you have to create a line between points *1 0 0* and *1 0 1*, the other two points will be used later. For that type the command *qlin*, move the mouse inside the drawing area. Type *r*, move the mouse pointer to the right and down, type *r* again. Move the mouse over the first point of the line and press *b* (for begin), then move the pointer of the mouse to the next point and type *g*. Type *plus la all* to label the lines that just were created. Type *save* to save the geometry.
- (3) A set should be created now, for that type *qadd set1 enter*, then type *a*, after that move the mouse pointer to the left upper corner and type *r*, move the mouse to the right bottom and type *r* again. Move the mouse such that the line is inside the rectangle and type *l*, finally type *q*.
- (4) At this point we will use the command *swep* to generate a quarter of the cylinder. For that we will use the line *set1* that we just create and the point *p1* and *p4* that are located in the middle of the cylinder. Type the command *swep set1 arc1 rot p1 p4 90* In this command, *arc1* is the name of the arc that we are creating, *rot p1 p4* means that the line *set1* will be rotated around the line connecting the point *p1* and *p4*, and *90* means that the rotation angle is 90.
- (5) The default number of divisions of the lines created is 4; to increase that number type *qdiv* then type *a* and create a rectangle by typing *r* (as in step (3)), place the rectangle on the lines and type the number of divisions in the lines that you want. The following figure shows the difference between the original surface and the new surface with more divisions.



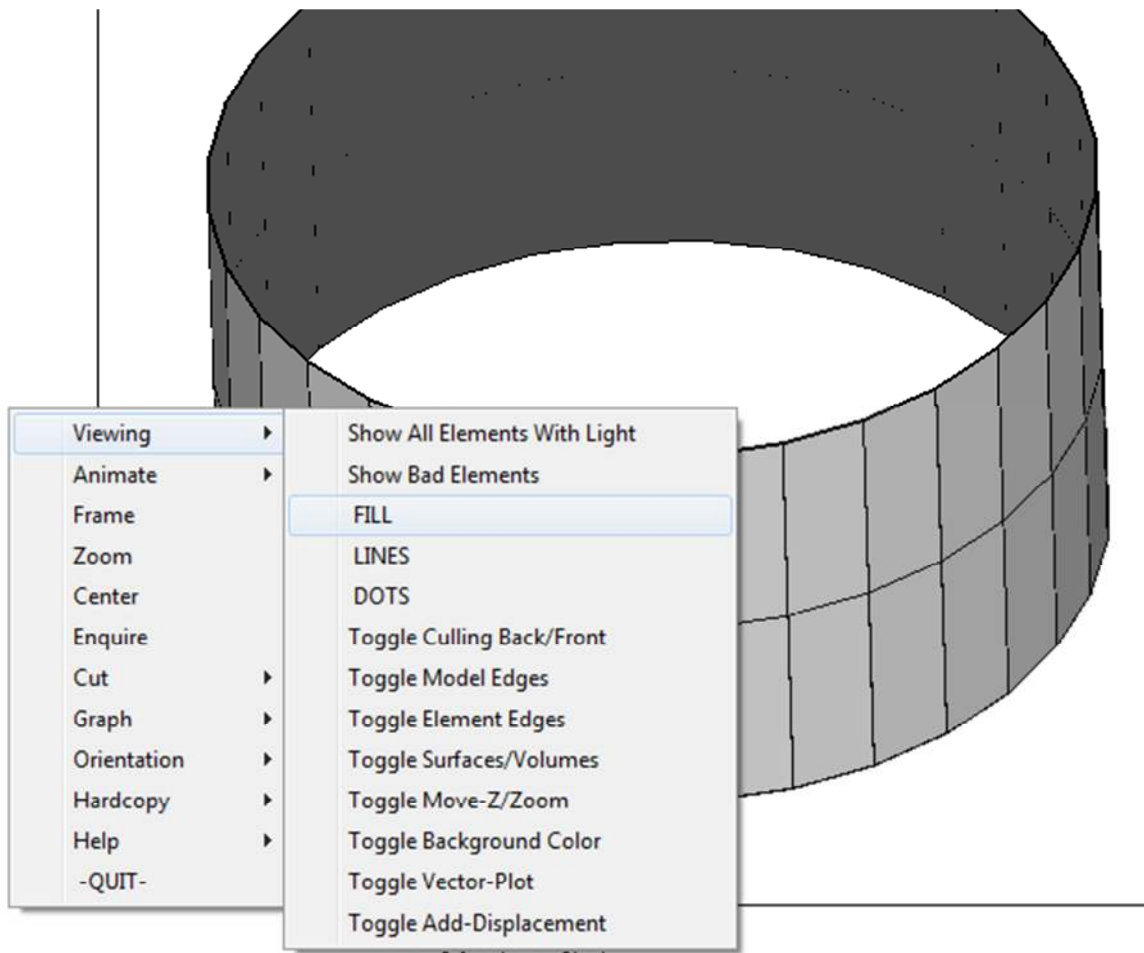
(6) By using the command `mirror` we now complete half of the cylinder by using the same command but with a rotation of -90 degrees.

(7) With that geometry create a new set following the step (3)

(8) Once created the new set, use that set to complete the cylinder doing a mirror operation. For that use the command `swep set3 set4 mir p1 p2` In that command set 3 is the set that you just created in step 8, set4 is the geometry that you are creating right now, p1 and p2 are points that define a vector normal to the plane of mirror. That plane will be located at point p2.

(9) Now create a new set (following step (3)), which contains the whole geometry.

(10) Finally, define the element type by using the command `elty all qu4`, and then mesh the part by using the command `mesh all`. To see the elements you can press left click with the mouse in the draw window, then chose Viewing and Fill as indicated in the figure below.



## CREATE A DISC

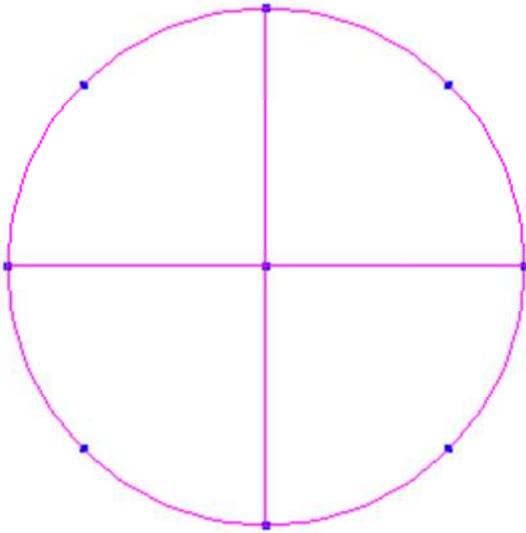
Now we are going to create a disc with radius 1

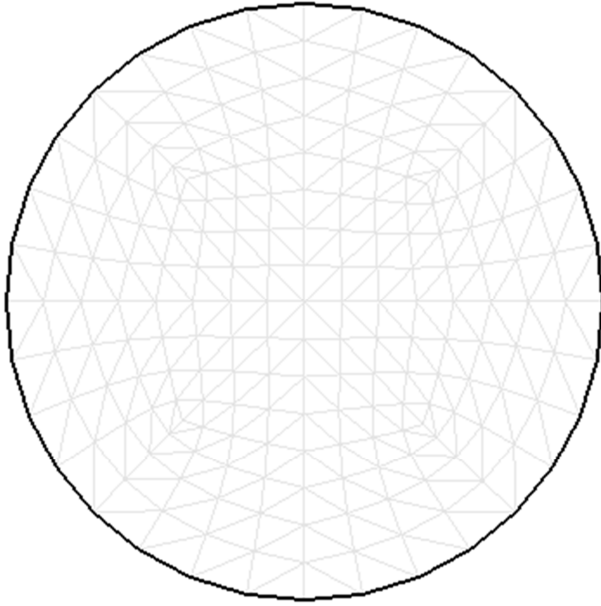
The commands used in this case are very similar to those used in the case of the cylinder.

Remember that first you have to go to the menu beginning>all programs>bConverged>Calculix>Calculix Command; then open a new file and give to it a new name. Then give the following commands

(1) Create two points: pnt p1 0 0 0 ENTER pnt p2 1 0 0 ENTER

- (2) Create a line with the following commands: `qlin r r b g q`
- (3) Create a set called `line1` by using the following commands `qadd line1 r r l`
- (4) Create a new point called `p3` with coordinates `0 0 1`
- (5) Create a quarter of circle by using the command: `swep line1 arc1 p1 p3 90`
- (6) Repeat the command but this time rotate `-90` instead of `90`; also remember change the name to the new arc
- (7) Create a new set called `arc3` (see point (3))
- (8) use the command `mirror` to complete the disc: `swep disco arc3 mir p2 p1` In this case the plane of mirror is located in the point `p1` which is at the center of the disc.
- (9) Create a new set with the whole disc using the command `qadd`
- (10) Set the element type with the command `elty all qu4` and finally mesh the disc with the command `mesh all`





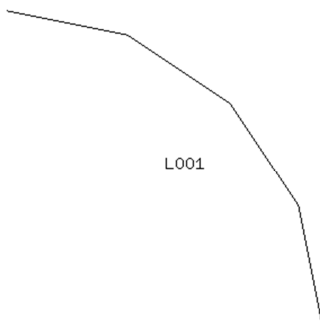
## CREATE A SPHERE

Now we will use some simple commands to create a hollow sphere

(1) Create points pnt p1 0 0 0, pnt p2 1 0 0, and pnt p3 0 0 1

(2) Define a set with point 2 using qadd command

(3) create an arc by using the command swept with the set defined in the last step and rotating around points p1 and p3 as show in next figure.

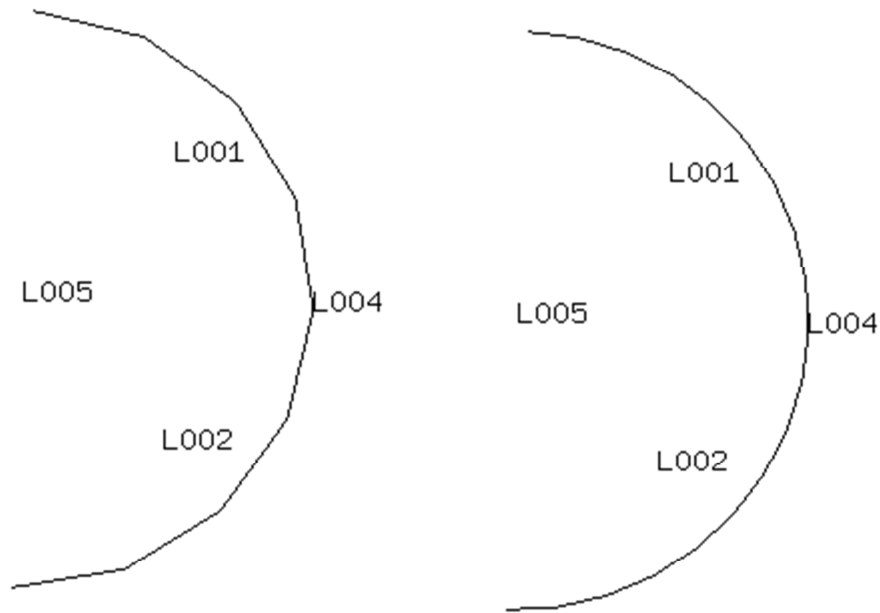


(4) Create a new set by using qadd with the new line

(5) Mirror the first set with respect to points p1 and p2

(6) Use the command qadd to create a new set with the two lines

(7) Use the command qdiv to divide in more spaces the lines. The following figure shows the difference between before and after the division.



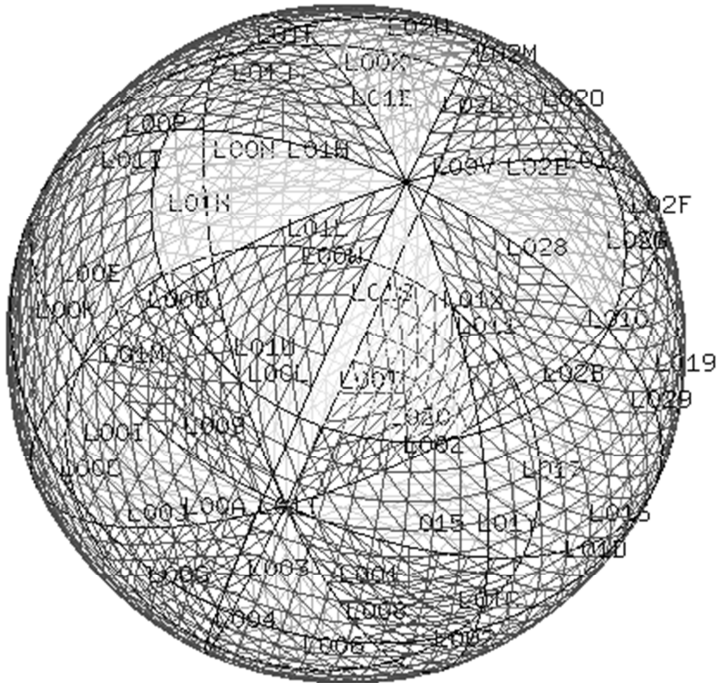
(8) Use the command swep arc4 set3 rot p1 p2 90 to generate a quarter of sphere. In this command arc4 is the new geometry, set3 is the set created in point (6)

(9) Create a new set with the geometry before created (arc4)

(10) with the last set perform mirror to generate half of sphere, and again mirror to complete the whole sphere. Before every mirror operation, a set should be created using the command qadd.

(11) Use the commands elty and mesh to select the element type and mesh the geometry. The following figure shows the model.





## SOLID SPHERE

A solid sphere can be obtained in the same procedure that the disc was obtained but before doing the last mirror to complete the disc, do the command: `sweep set1 set2 rot p1 p2 90`. In this command set1 is the half disc, set 2 is the new quarter of sphere, p1 and p2 are two points in the diameter of the half disc and 90 is the rotation angle. After that do two successive mirror operation to complete the sphere; remember that before any mirror (sweep) operation you have to define a new set.

## SEGMENT OF SPHERE

- (1) Create three points with coordinates 0 0 0, 0 0 1, 0 1 1.
- (2) Create a set with point of coordinates 0 0 0
- (3) Use the command `sweep point arc 1 rot p2 p3 90` to generate an arc
- (4) Use the command `qdiv` to divide the arc in more parts
- (5) Use the command `qadd` to create a set with the arc created before

(6) use the command `swep set2 sphere rot p1 p2 45` to create the segment of sphere. In that command `set2` is the line created before `sphere` is the name given to the sphere `p1` and `p2` are the points on the rotation axis and `45` (or the angle that you want is the rotation angle)

(7) Finally create a new set, define the element and mesh the geometry.

