# Using SSIIM 2 to make an STL file

Most general-purpose CFD programs will make the computational grid geometry with the help of an STL file. This file describes the geometry of an object, for example an aeroplane, a car, a gate, a spillway or a river bed. The STL file contains triangles with (x,y,z) coordinates that describes a general surface. The file is read by the CFD program, for example OpenFOAM or STAR-CCM+.

SSIIM 2 has two different functions to write STL files. They are both invoked when choosing File->Write STL file from the menu. The first function will write several STL files describing the bed, sides and surface of the SSIIM 2 grid. Then the SSIIM 2 grid first has to be adapted to the river geometry. That is, the computational grid for SSIIM 2 has to be made.

The other function writes an STL file for a structure, typically a weir. This file is called weir.stl. The weir geometry is made on the basis of a file that must be called weir.txt. The weir.txt file must be arranged as follows:

x11 y11 z11 x12 y12 z12
x21 y21 z21 x22 y22 z22
x31 x31 z31 x32 y32 x32
..

Each line in the file has six floating point numbers. These are the (x,y,z) numbers for two coordinate points. The numbers are shown in the figure below.
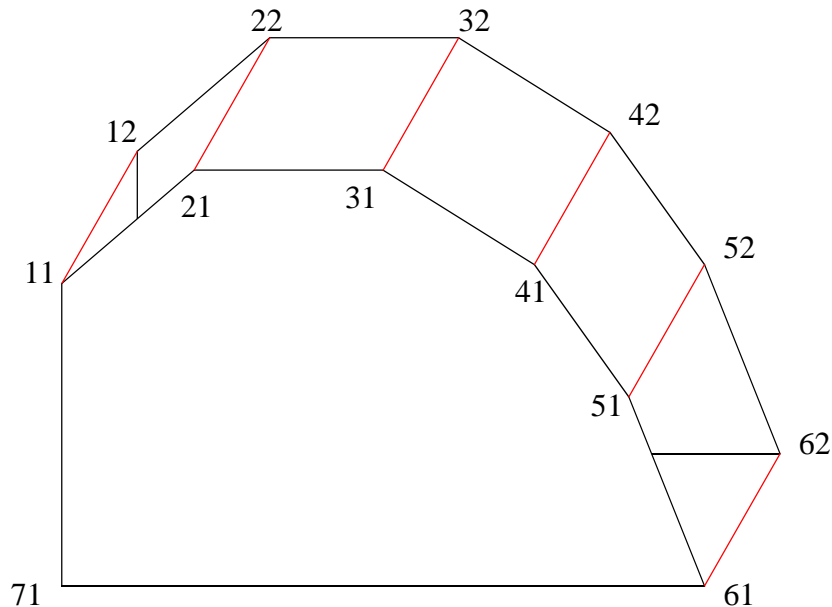
The figure above shows a weir defined with 2 x 7 points. It is possible (and recommended) to use more than 7 points, to get a better detail of the weir.

1	0	0	1	1	0
1	0	0.361405271	1	1	0.361405271
1.01	0	0.364350092	1.01	1	0.364350092
1.02	0	0.366710298	1.02	1	0.366710298
1.03	0	0.368465012	1.03	1	0.368465012
1.04	0	0.369582969	1.04	1	0.369582969
1.05	0	0.37	1.05	1	0.37
1.06	0	0.369582969	1.06	1	0.369582969
1.07	0	0.368465012	1.07	1	0.368465012
1.08	0	0.366710298	1.08	1	0.366710298
1.09	0	0.364350092	1.09	1	0.364350092
1.1	0	0.361405271	1.1	1	0.361405271
1.11	0	0.357891428	1.11	1	0.357891428
1.12	0	0.353820954	1.12	1	0.353820954
1.13	0	0.349204098	1.13	1	0.349204098
1.14	0	0.344049573	1.14	1	0.344049573
1.15	0	0.338364945	1.15	1	0.338364945
1.16	0	0.332156888	1.16	1	0.332156888
1.17	0	0.325431365	1.17	1	0.325431365
1.18	0	0.318193758	1.18	1	0.318193758
1.19	0	0.310448967	1.19	1	0.310448967
1.2	0	0.302201489	1.2	1	0.302201489

The figure/table above shows an example of how a part of the weir.txt file may look.

To make the weir.txt file, it is recommended to use a spreadsheet. The formula for the geometry of an ogee weir is a parabola:

$$\frac{z}{H_0} = -K\left(\frac{x}{H_0}\right)^n$$

Here, x is the horizontal direction (direction of the flow) and z is the vertical direction. The parameter K is a coefficient that usually has a value around 0.50-0.54. H_0 is the energy height behind the weir at the design discharge. The parameter n is usually between 1.75 and 1.87.

The spreadsheet can be arranged so that x for the right side of the spillway is in the first column. Then y for the right side is given as a constant value in the second column. Then z is computed in the third column according to the formula above. The fourth column gives the x value for the left side of the spillway. Which can be copied from the first column. The y value for the left side can be given as a constant in the fifth column, and must be different from the y value for the right side. Then the z value for the right side is given in the sixth column. This value can be copied from the third column.

After all the points are made, the content is saved as a text file (.*prn* in Excel), with the name *weir.txt*.

After SSIIM is run, and the *weir.stl* file is made, the weir can be read by the program paraView. A 3D view of the weir is then seen, which can be rotated and inspected for errors.

Note that the algorithm to make the *weir.stl* file was made in March 2016, so that it is necessary to use a SSIIM version made after this time.