Tutorial CFD
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Tutorial 7

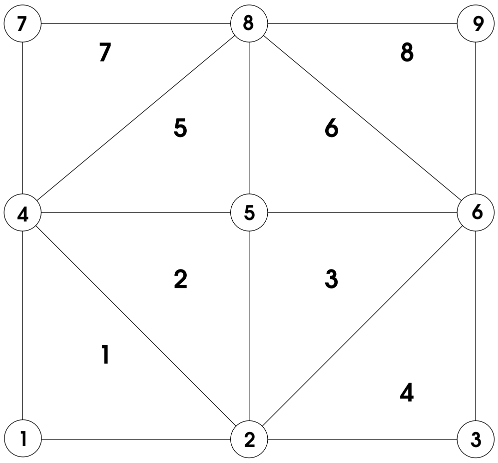
To be discussed on: Monday, 30.06.
Download: www.mathematik.uni-kl.de/~rutka/CFD_tutorial.html

Programming Exercise: Triangulation

Description of data format

Triangulation of a two dimensional domain is typically characterized by two arrays, typically stored in two or one file: the first one storing the coordinates of the nodes (let us call it *.nod format) and the second storing which node numbers correspond to each triangle (*.tri files).

Consider situation like in the following picture. The node numbers are in circles, the triangle numbers are without circles around them. The node 1 has coordinates $(0, 0)$, and the node 9 has coordinates $(1, 1)$.



Suppose, the triangulation information is stored in files test.nod and test.tri. Then, these files would be:

```
test.nod
0   0
0.5 0
1   0
0   0.5
0.5 0.5
1   0.5
0   1
0.5 1
1   1
```

```
test.tri
1 2 4
2 5 4
2 6 5
2 3 6
4 5 8
5 6 8
4 8 7
6 9 8
```

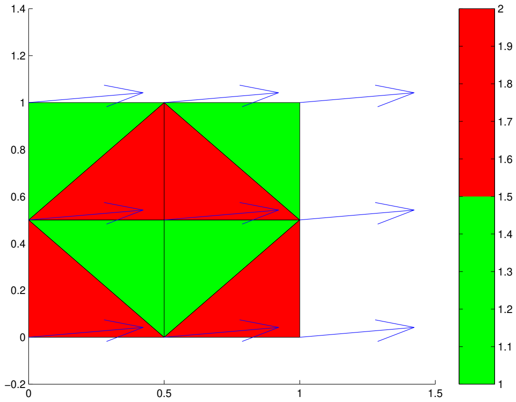
I.e., the i-th line of the file test.nod tells the coordinates of the i-th node. The j-th line of the file test.tri tells the nodes which are determining the triangle j.

Remark: This is the minimal necessary information which is needed to be able to reconstruct the triangulation. It is contained in all data formats which are used in FEM packages, like FEMLAB, ANSYS, etc. Different data formats differ by different rearranging of lines (e.g., store everything in one file, at first the triangle information, then node coordinates). Some data formats contain more information, like normals of the triangles, some phase indices, etc.

Your task

Given a constant vector field $\underline{a} = (a_1, a_2)$. For each triangle determine whether it is one-inflow-side triangle, or two-inflow-sides triangle (see the lecture notes, fluctuation splitting schemes in 2D for the definitions). Plot one-inflow side triangles in one, and two-inflow-sides triangles in another color.

For the example before with vector field $a = (1, 0.1)$ you should be getting the following picture:



Once you have done it, you can try files {square.tri, square.nod} and {xshape.tri, xshape.nod} available at the web-site of the tutorial. Triangulations see below (generated by FEMLAB):