Institute for Applied Mathematics
Heidelberg University
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Problem Set 4 – Gascoigne Workshop
Summer Term 2013

Changing the Grid

Use `cp -r /srv/share/gascoigne/2013/ps3 .`

Problem 4.1:

Solve the Poisson problem $-\Delta u = 1$ on the L-shaped domain Ω_L, with homogeneous Dirichlet boundary conditions on the whole boundary. The domain Ω_L is defined in the figure on the right.
Inner lines of the quads are not needed for the calculation and refinement process and, therefore, avoided in the `inp`-file. In contrast to the inner lines the boundary lines have to be defined in the file and must be labeled with color values.

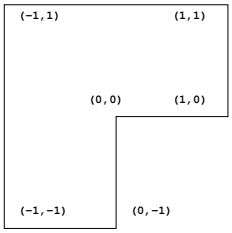

Abbildung 1:

Problem 4.2:

Solve the same problem as in **Problem 4.1** for the slit domain Ω_S in **Figure 2**. The line $(0,0)$-$(0,-1)$ is in this case a boundary line. Two adjacent quads are not allowed to share a common boundary line. Hence, you need to add the point $(0,-1)$ twice in the `inp`-file. Now you can define two different boundary lines from $(0,0)$ to $(0,-1)$ by using the two points in $(0,-1)$.

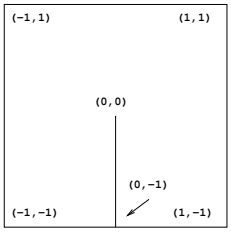

Abbildung 2:

Problem 4.3: (*Curved boundaries*)

The aim of this exercise is to solve the Poisson problem from **Problem 4.1** on the circular domain $\Omega_C = \{x \in \mathbb{R}^2 : \|x\| < 1\}$.

Typically, GASCOIGNE uses polygonal domains. In order to have a good polygonal approximation of the circular domain, we *pull all new boundary nodes onto the circle* after every step of refinement. The circle is defined in `BoundaryFunction` in the file `mymeshagent.h`.

In the class `MyMeshAgent` the function `AddShape(9,&K)` is responsible for the connection between boundary colors and the curved boundary parts, which is in this case the circle defined in the `class Kreis`. Uncomment the line and change the `main.cc`, such that the file `kreis.param` is used in the computations.

Problem 4.4: (*optional*)

Solve the same Poisson problem on an ellipse with diameters $a = 2$ and $b = 1$ in x- and y-direction, respectively. Try different values of a and b.