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1. Homework for Course

Inside Finite Elements

http://www.zib.de/weiser/FEM-2019/

WS 2019/20

Due to: October 28

1. Exercise *Useful Software* (4 points)
Become familiar to the programs triangle by J. Shewchuk and Paraview by Kitware Inc.

Use triangle to generate a triangular grid for the initial letter of your name. Consider the options `-a` and `-q`. Submit the output files `???.1.node` and `???.1.ele` (via email to `weiser@zib.de`).

Create a nice 3D picture of the Mandelbrot set with Paraview. Use the data source `Mandelbrot` and the filters `Clean to Grid`, `Calculator` und `Warp by Scalar`. Submit a screenshot of the whole Paraview window.

Hint: The required programs can be found at `http://www.cs.cmu.edu/~quake/triangle.html` in form of an easily compilable source code, and `http://www.paraview.org/` in form of an executable for different platforms, respectively.

2. Exercise *Boundary Conditions* (2 points)
For the diffusion equation

$$\dot{u} = \Delta u$$

let the Robin boundary condition

$$n^T \nabla u + \alpha u = \beta$$

be given. Which sign needs α to have to be compatible with thermodynamics (and common sense)?

3. Exercise *Input of Triangular Grids* (4 points)
Write a function

```
function G = readPolyMesh(fname)
```

that reads a 2D triangular grid in .poly format as it is written, e.g., by the grid generator triangle (`http://www.cs.cmu.edu/~quake/triangle.html`). The file `fname.node` contains the nodes, the file `fname.ele` the elements.

The grid `G` shall be a structure with two entries `xp` and `pt` of dimension $(2, n)$ and $(3, m)$, respectively. `xp` contains the coordinates of the n nodes and `pt` the indices of the m triangles.