

Berlin, 18.11.2013

Numerical Mathematics IV

Exercise Problems 01

Attention: The approach for getting a solution has to be clearly presented. All statements have to be proved, auxiliary calculations have to be written down. Statements given in the lectures can be used without proof.

1. Load the files provided on the homepage of this course. One of the files is the executable `rsh1_3d` (Linux, 64 bit) which solves the problem

$$-\Delta u = 1 \quad \text{in } (0,1)^3$$

with homogeneous boundary conditions. The files

`rsh1_3d_ssor.dat`, `rsh1_3d_cg.dat`, `rsh1_3d_mg.dat`,
`rsh1_3d_fgmrres_mg.dat`, `rsh1_3d_umfpack.dat`

contain the parameters for solving this problem with different solvers. Execute `chmod a+x ./rsh1_3d` and then the code runs by

```
./rsh1_3d rsh1_3d_ssor.dat
```

and so on. One will get an output file with the name `rsh1_3d_ssor.out` and so on.

Compile a table of the form of Table 2.1 from the lecture notes for this three-dimensional problem. The computing times for each level of refinement can be obtained with

```
grep time *.out
```

For the number of iterations, one has to check each output file individually. Interpret the obtained results.

Who is interested in the visualization of the solution should change in the data files “WRITE_VTK: 1”. Then, a picture in `vtk` format is written that can be visualized with the program `paraview` (free download from the internet).

4 points

2. Check the transform of the model problem to a symmetric problem from Remark 2.9. **4 points**

The exercise problems should be solved in groups of two or three students. They have to be submitted until **Nov. 25, 2013** either by email or in one of the classes.