MA 587: Homework 6

You may work in groups of two. For output include times, iteration counts or suitable graphs.

1. Consider the steady state 3D problem

\[-u_{xx} - u_{yy} - u_{zz} + 4u = 0 \text{ on } (\Omega \times (0,H)) \text{ where } H = 4.0 \text{ and }\]

\[u(x,1,z,t) = 212 \text{ and } u(x,y,z) = 70 \text{ on the other five faces of the boundary.}\]

Use `fem3d_rsmerror.m` with the three solvers `tridblock.m`, `cgfem3drsm.m` and `gmresfem3drsm.m`. Compare times and experiment with different `nx`, `ny` and `nz`, and preconditioners. Note the boundary condition in `fem3d_rsmerror.m` has changed.

2. Consider the steady state 1D nonlinear problem

\[-u_{xx} = c(u_{sur}^4 - u^4), u(0) = 900 = u(L).\]

Use the FEM (change fem1d.m) and the Picard iterative method to solve this problem. Experiment with variable `c`, `L` and number of nodes and let `u_{sur} = 273`.

3. Consider the steady state 1D nonlinear problem

\[-u_{xx} = c(u_{sur}^4 - u^4), u(0) = 900 = u(L).\]

Use the FEM (change fem1d.m) and the Newton iterative method to solve this problem. Experiment with variable `c`, `L` and number of nodes and let `u_{sur} = 273`. Compare your results with those in problem two.