MTH 655/9 Winter 2017 Finite Elements student contributions

Instructor: M. Peszynska

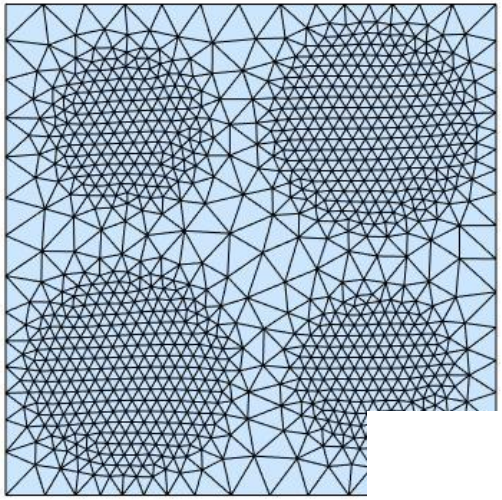
Mathematics, Oregon State University

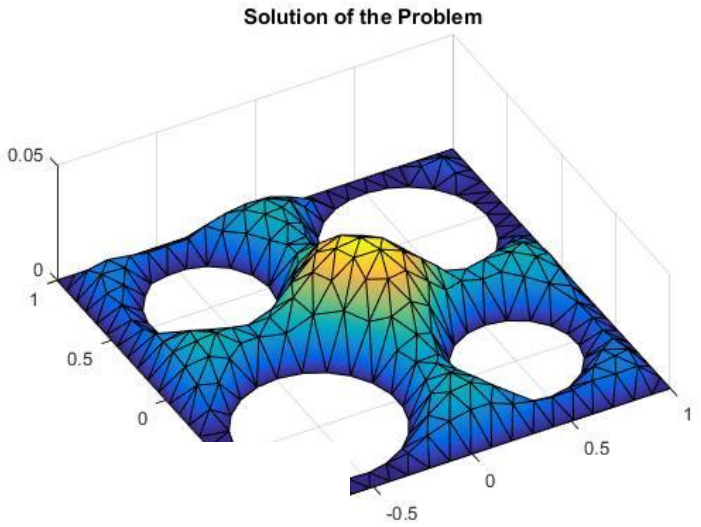
Solvers used

- Solvers used:
  - Fem1d_2017
  - ACF
  - IFISS
  - MFEM
  - Deal ii
  - FeNiCS
  - Moose
- Student contributors:
  - Math + Engrg (Nuclear, CCE, Wood)
  - AA, CS, DF, DH, ME, EH, TA, DW, JH, GX, ZY, DW, YQ, JU, WM, SK

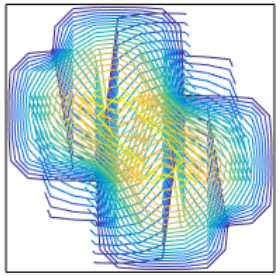
Grids with distmesh, mesh2d solution to Poisson's equation

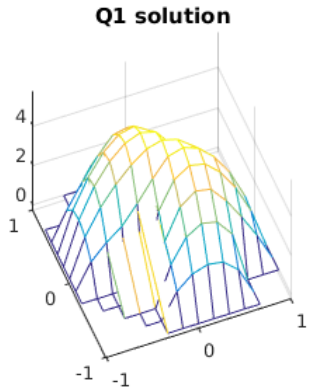
JU / DW





JU

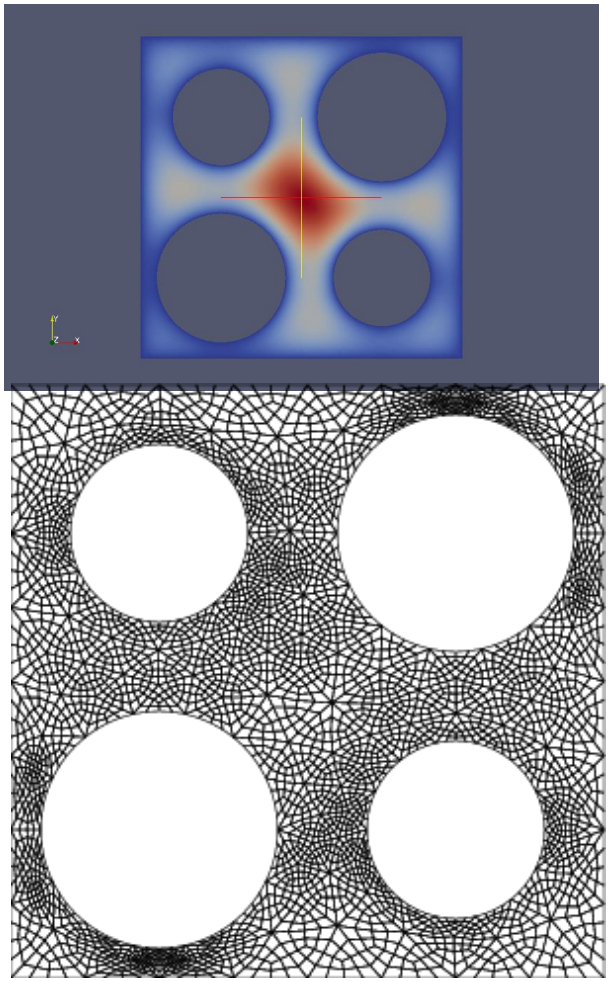


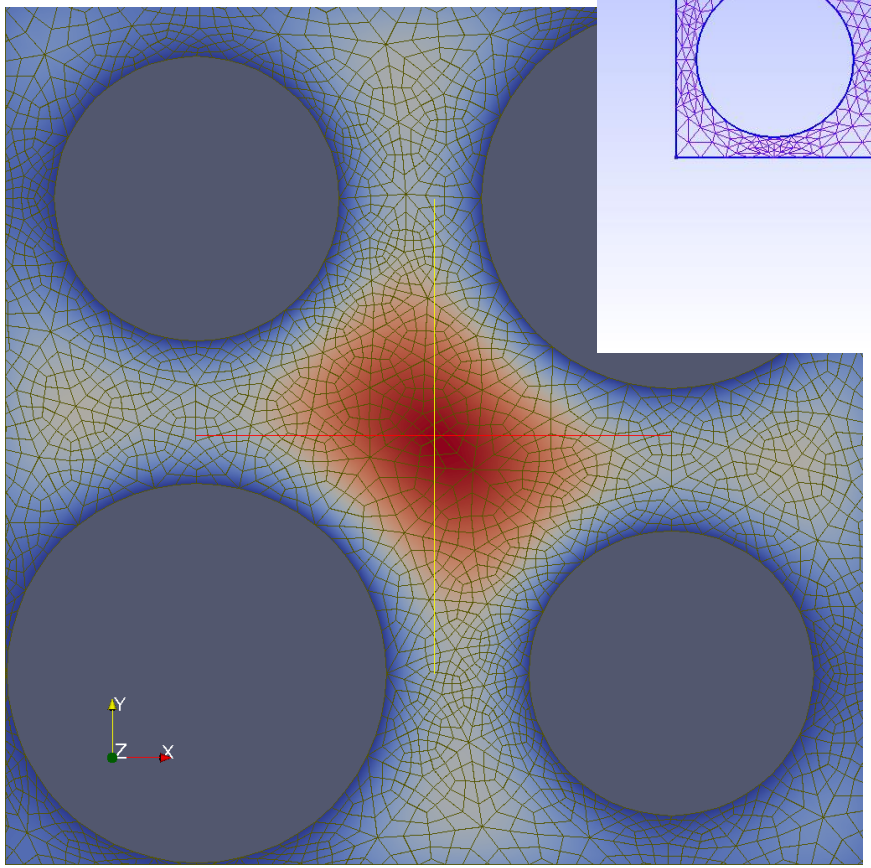


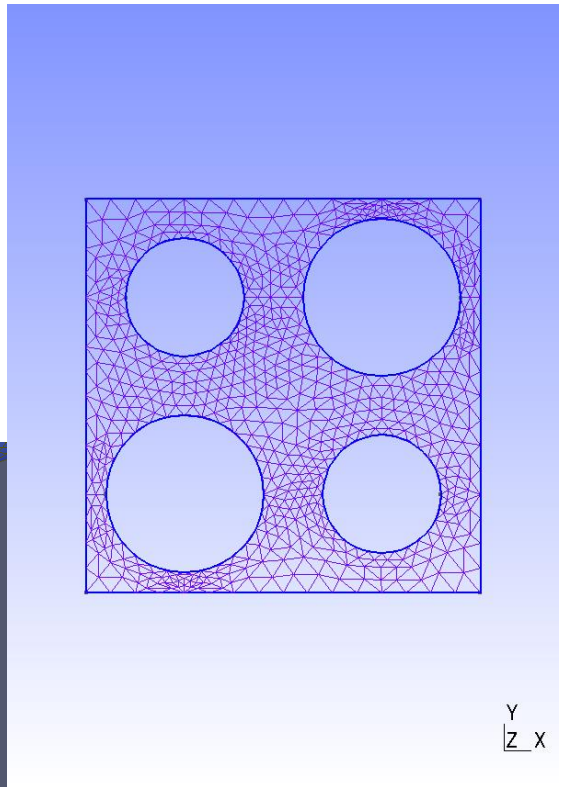
Grids, cd

SK

- Use deal ii, and Blossom for meshing

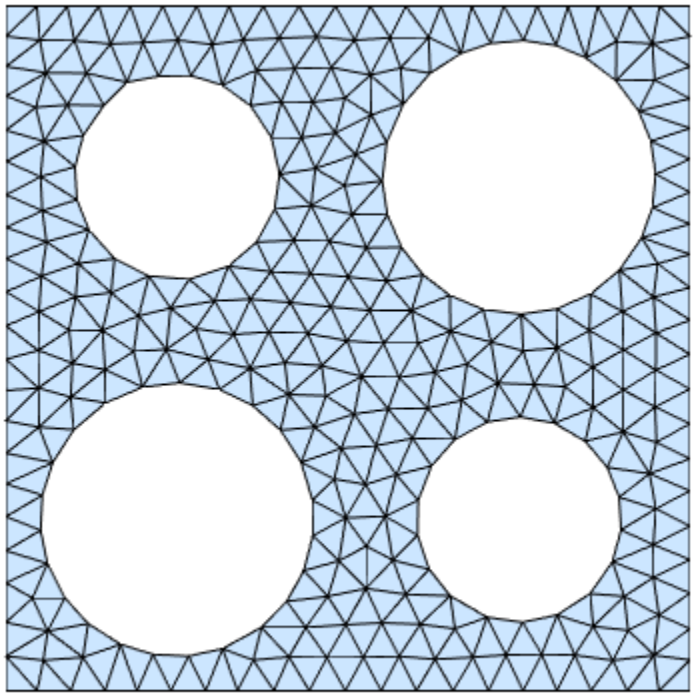




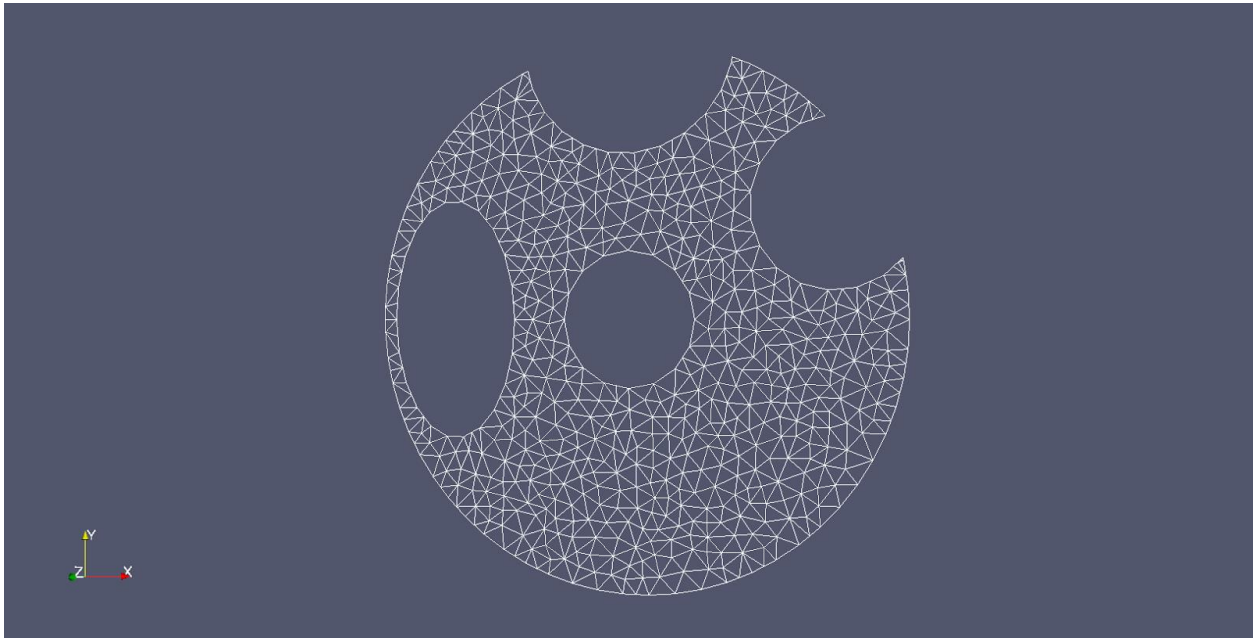


Cd

GX/DF



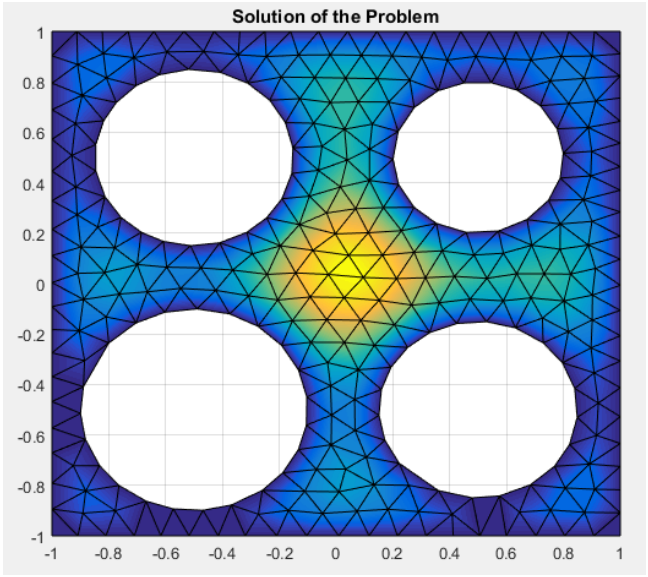
DF

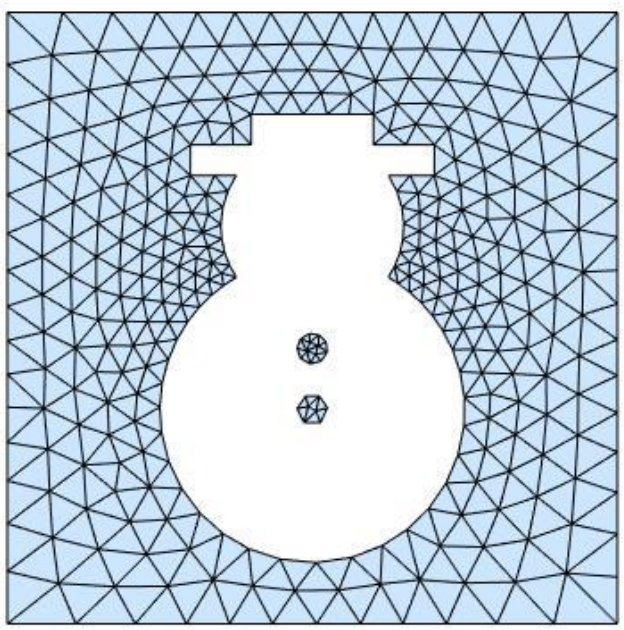


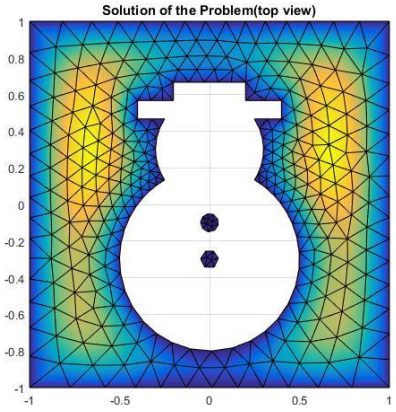
ZY

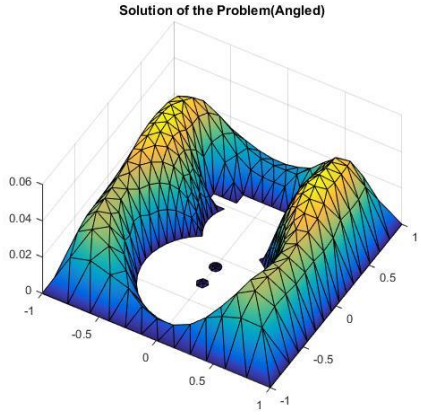
More exotics

AA/CS

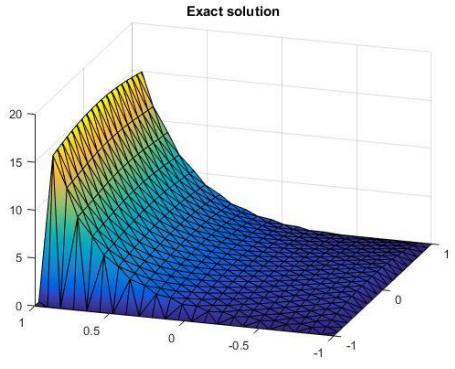


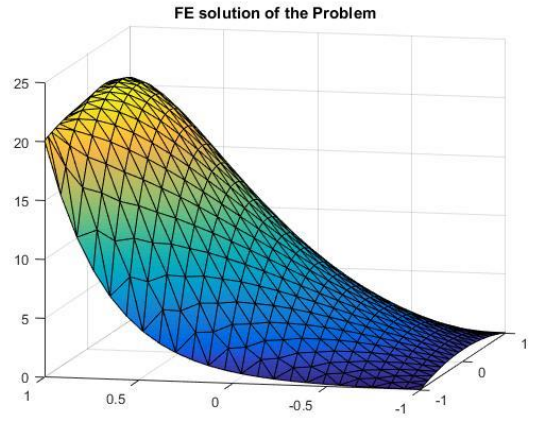


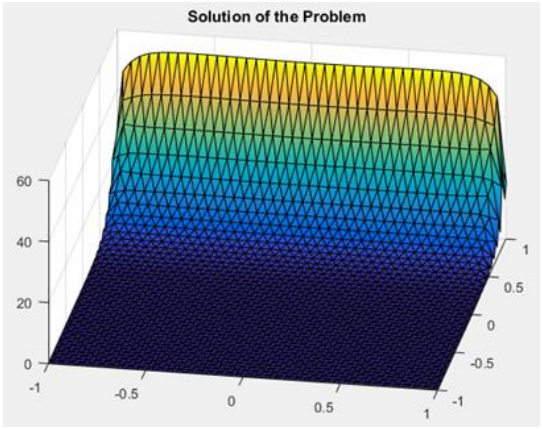


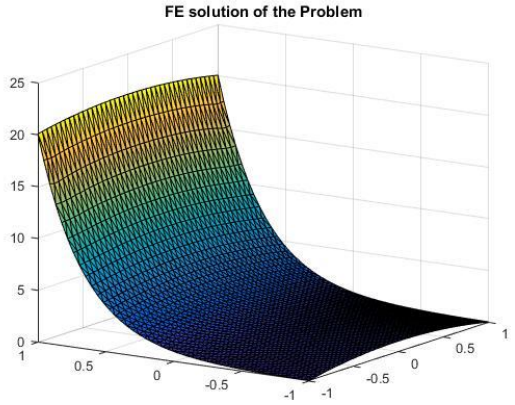


Sometimes something goes wrong (Lab 5)

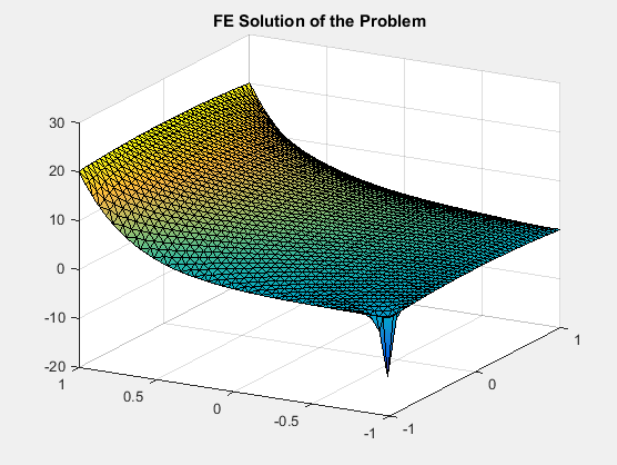


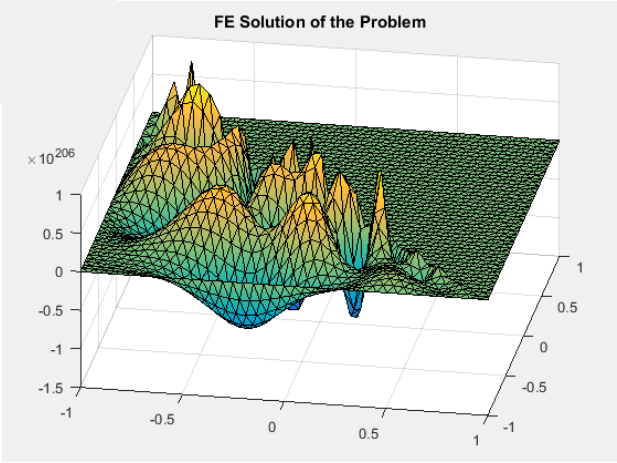


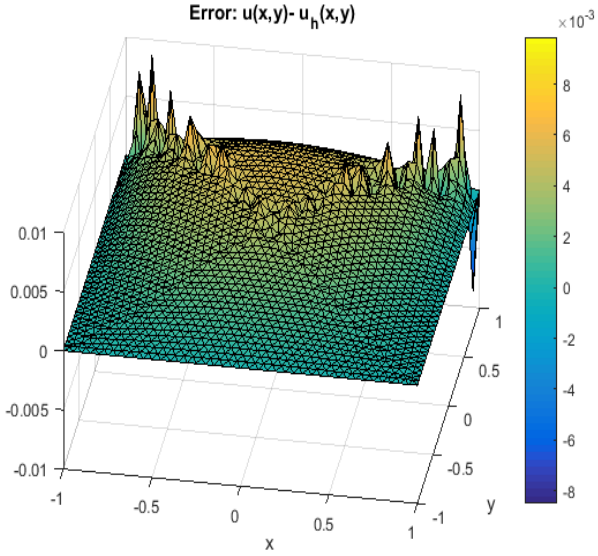




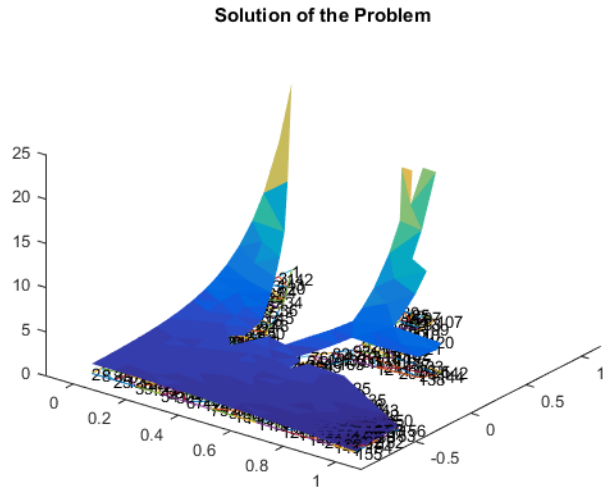
Lack of coercivity



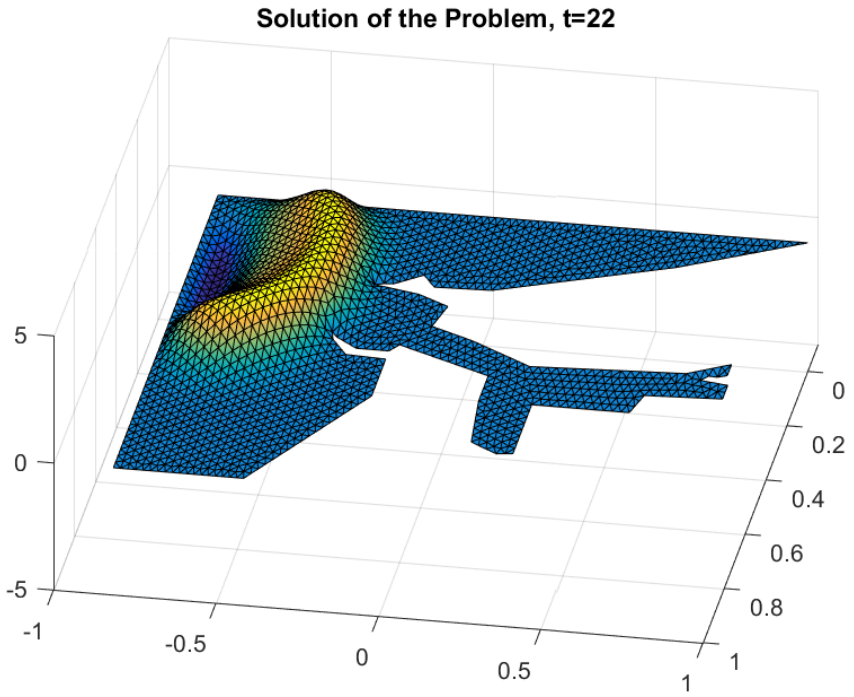




More exotic domains: solution to an elliptic equation and to the wave equations



WM



Eigenfunctions for an exotic domain

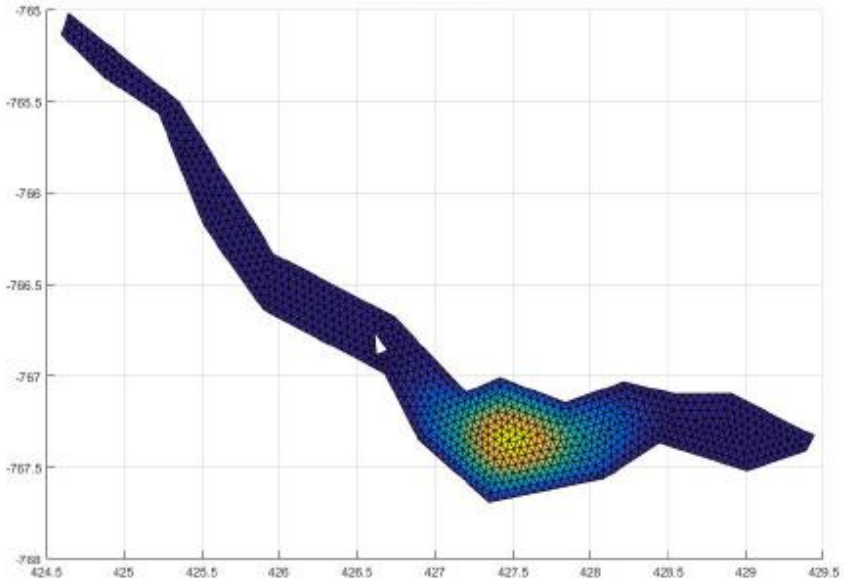


Figure 1: Final solution to heat equation for Cayuga Lake with homogenous Dirichlet boundary conditions; the negative space represents a fictitious island

ME/EH

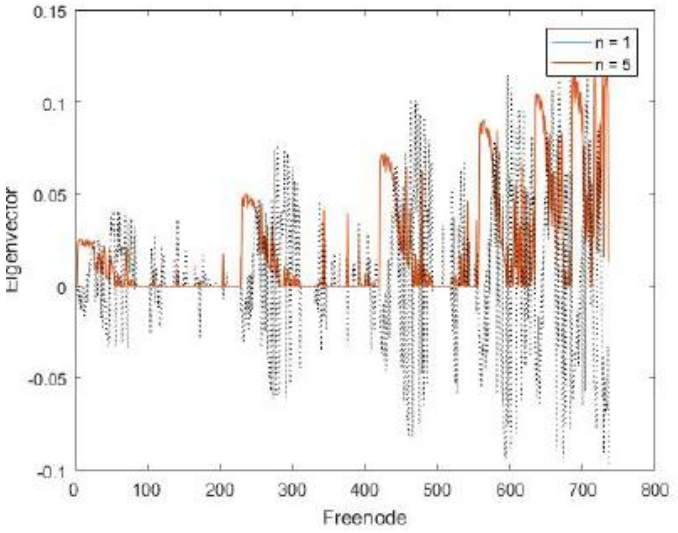
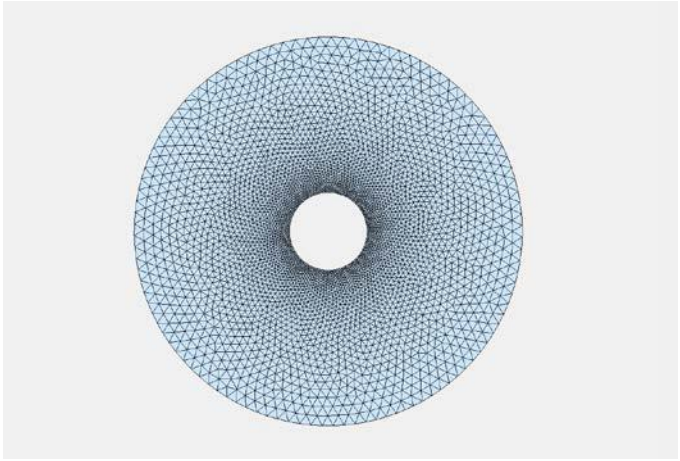
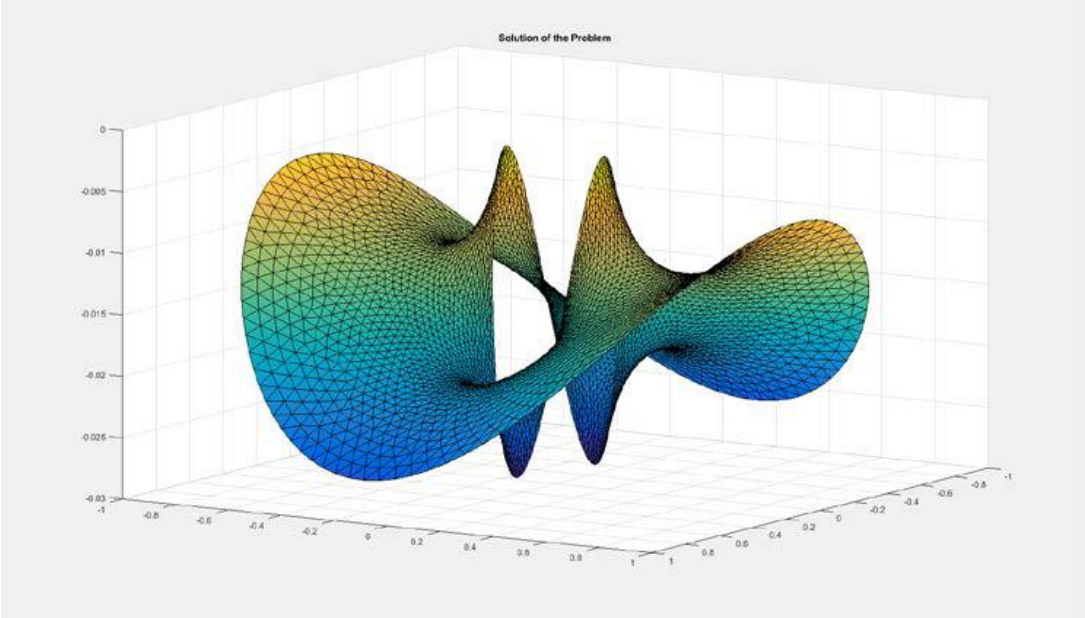


Figure 2: Eigenvectors for n = 1 and n = 5 for the final solution of the heat equation

More exotic domains and eigenfunctions

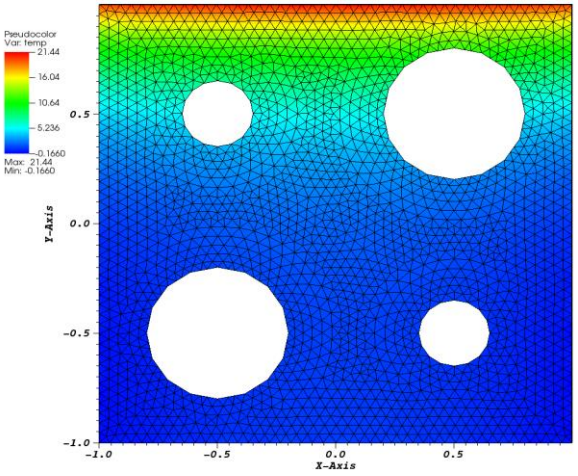
YQ

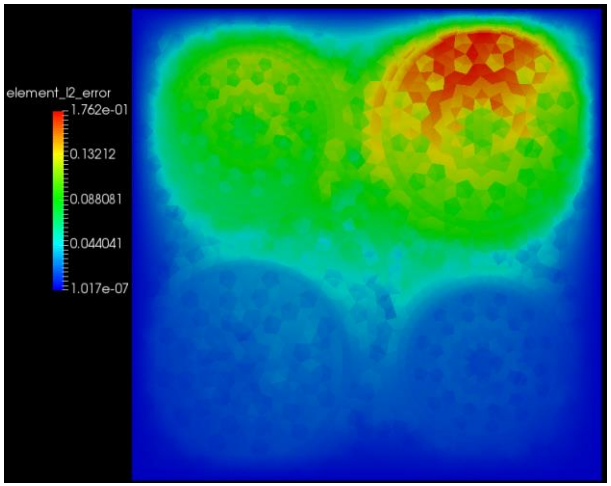




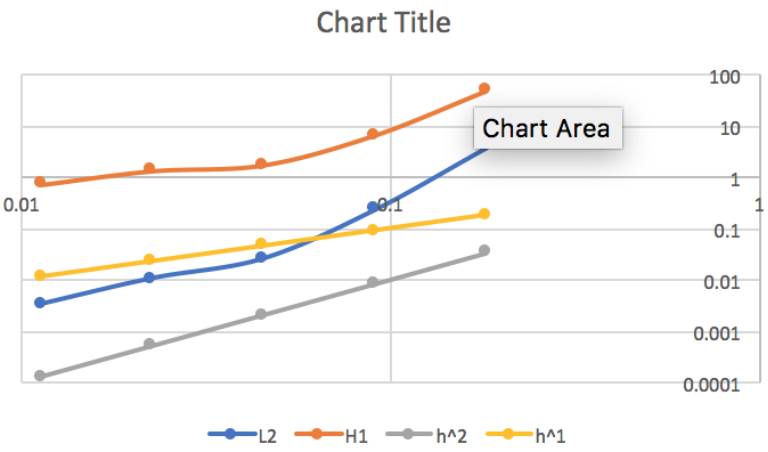
Sometimes something goes wrong (Lab 5)

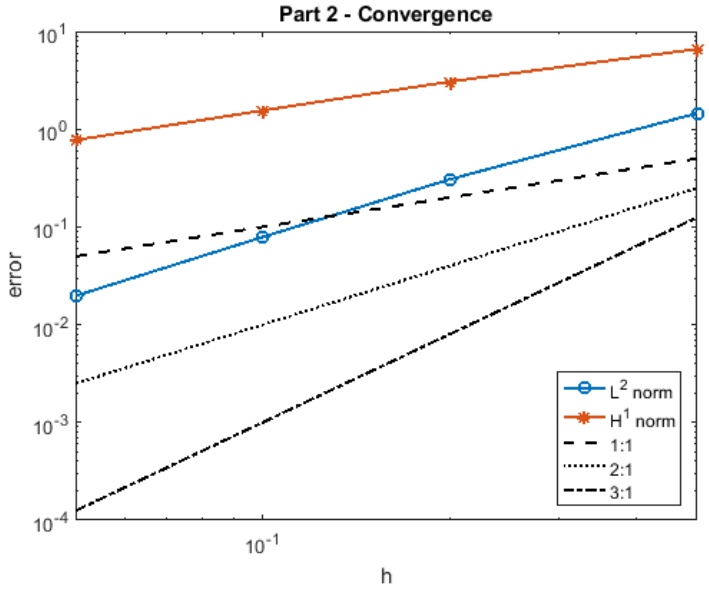
- But can be corrected

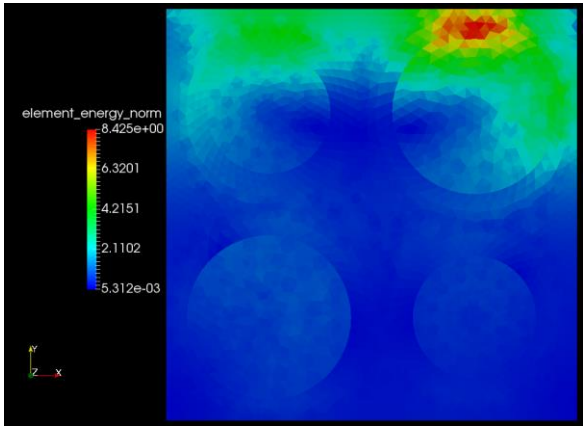


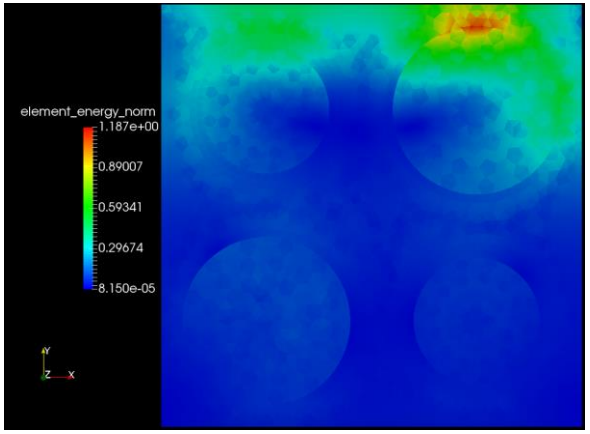


And eventually gets corrected



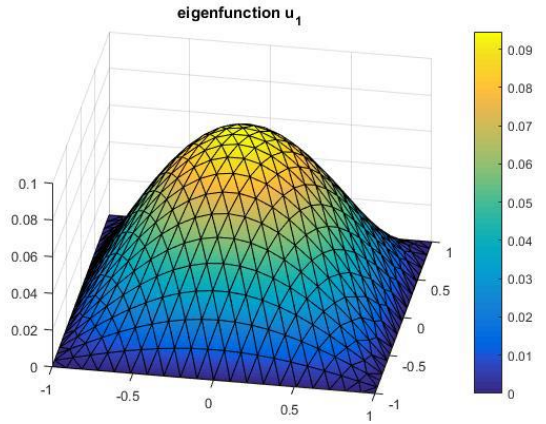


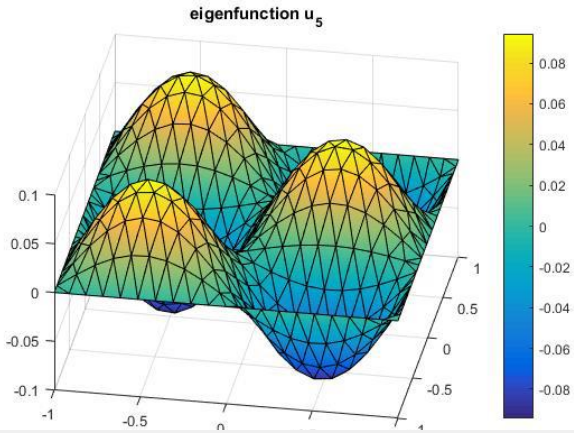


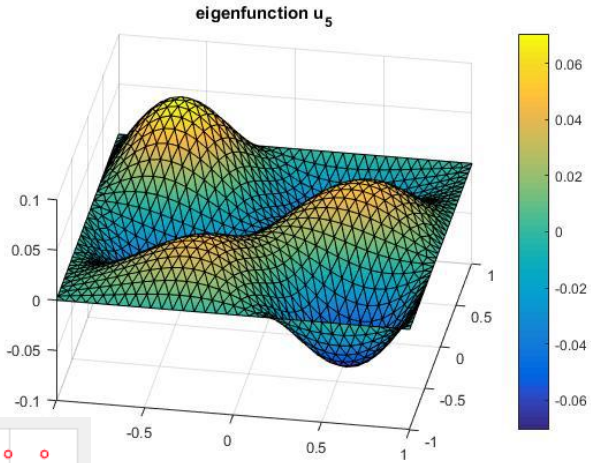


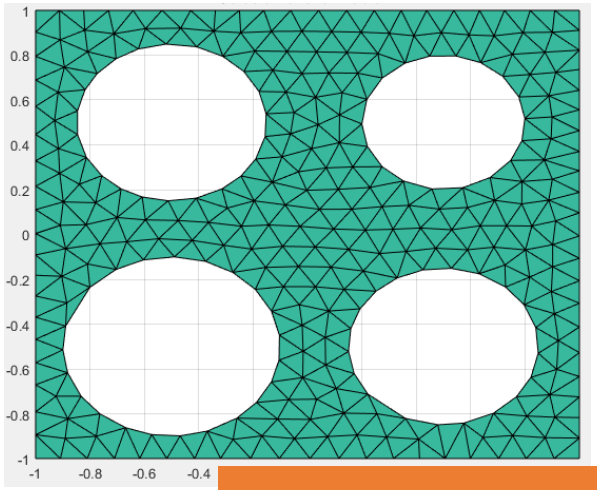
Eigenfunctions for Dirichlet problem

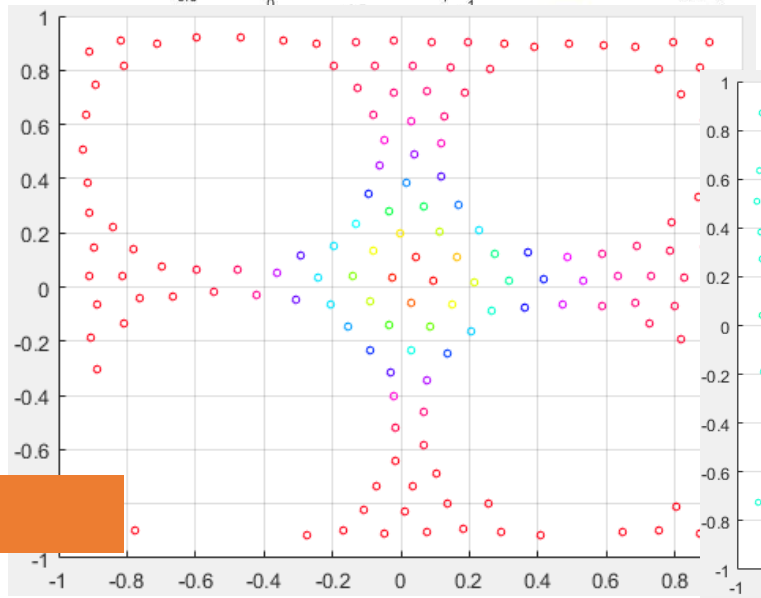
AA/CS

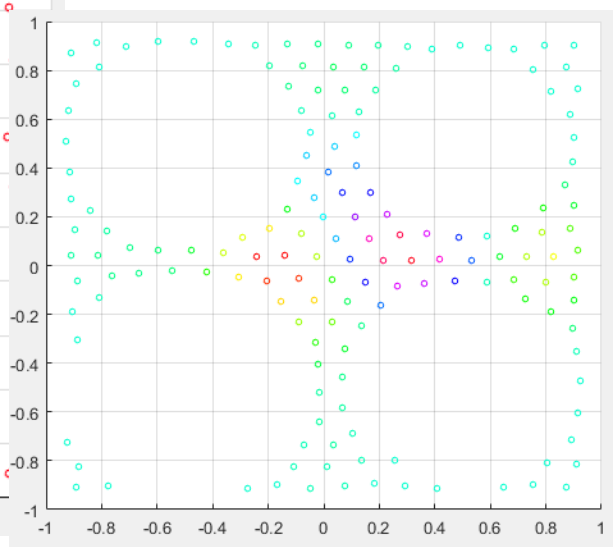






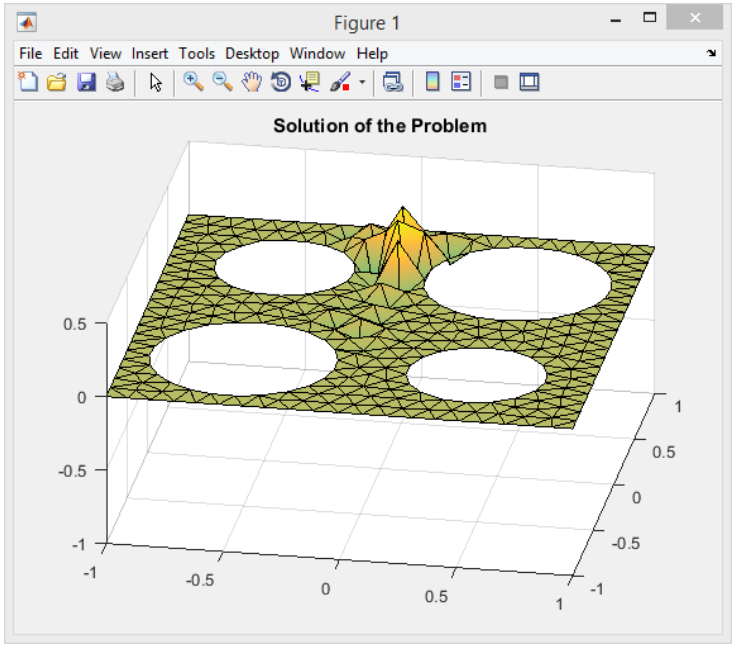


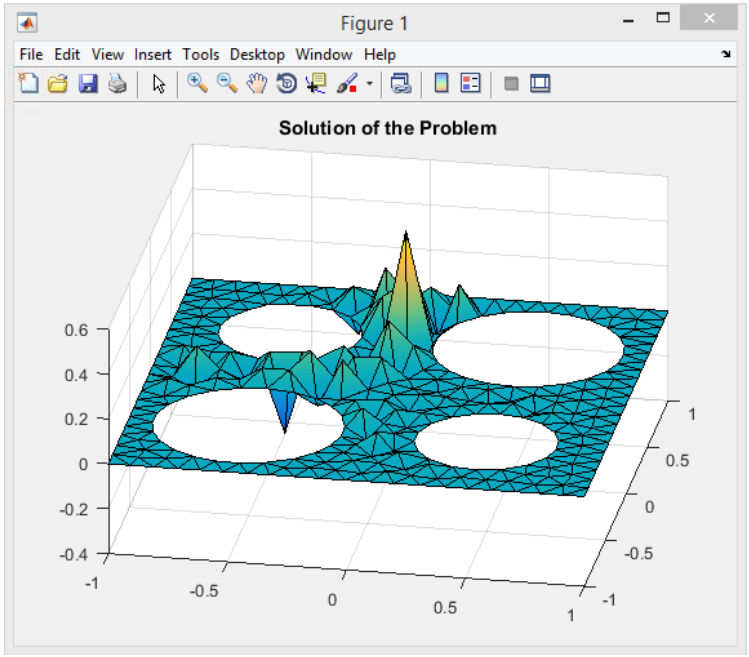




ZY

Eigenfunctions

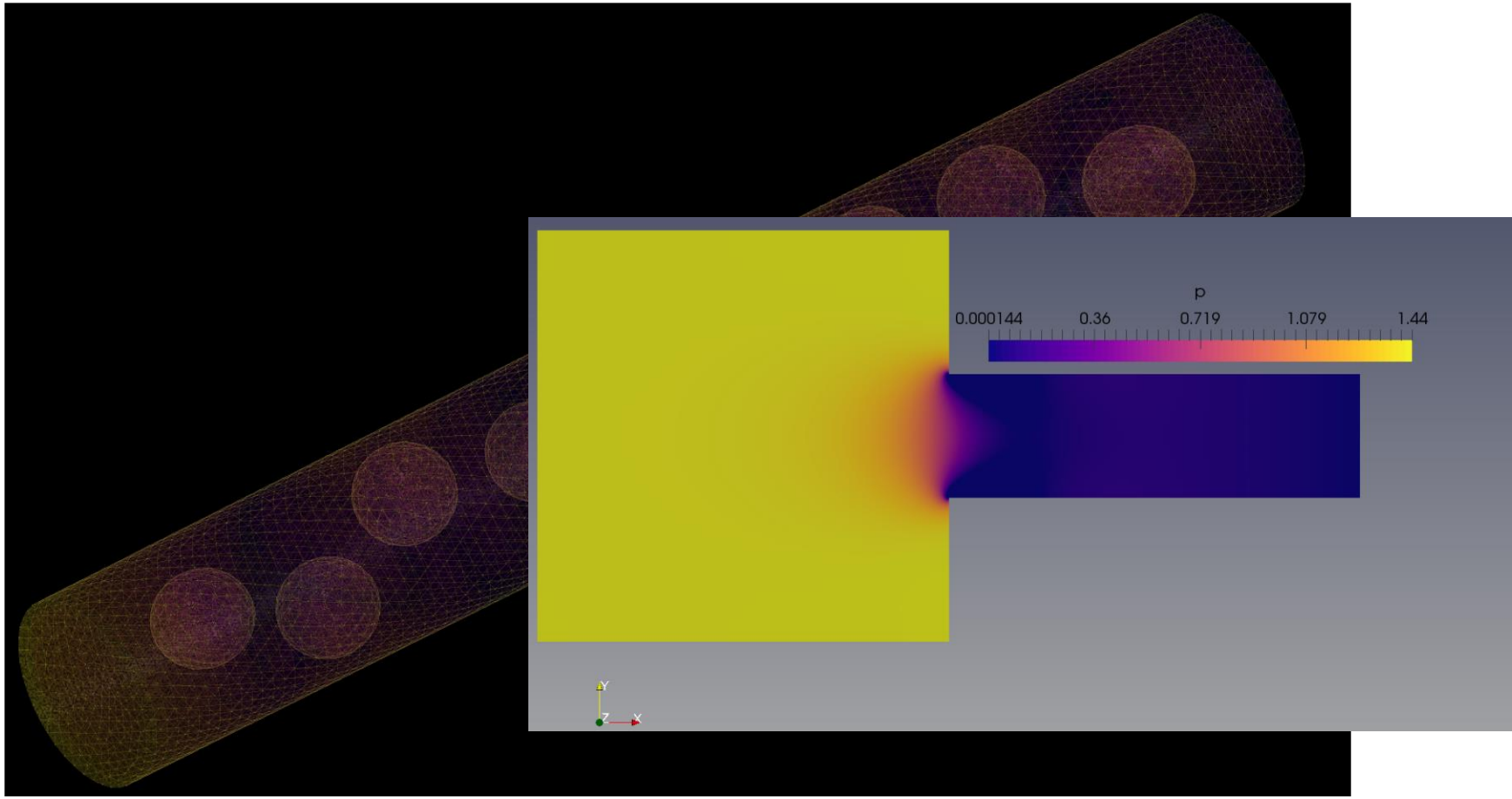




GX

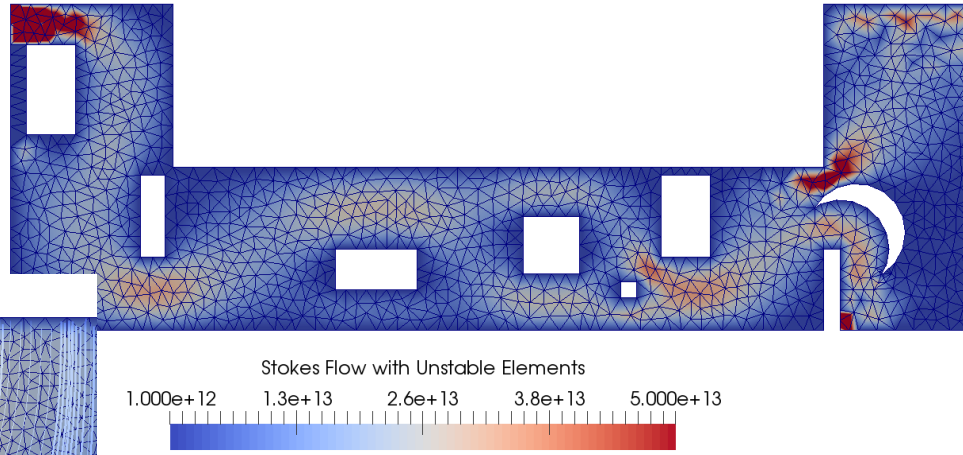
Stokes/Darcy, (Final project)

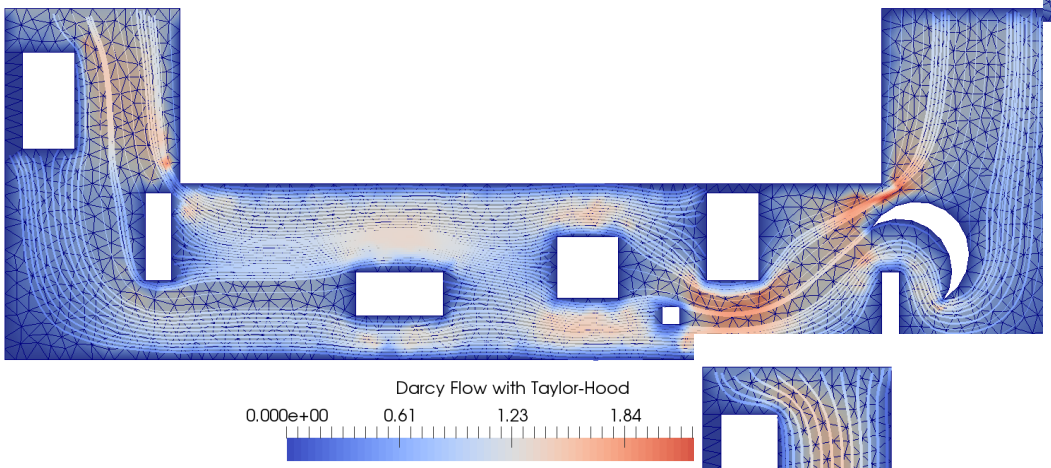
TA/JH/DW

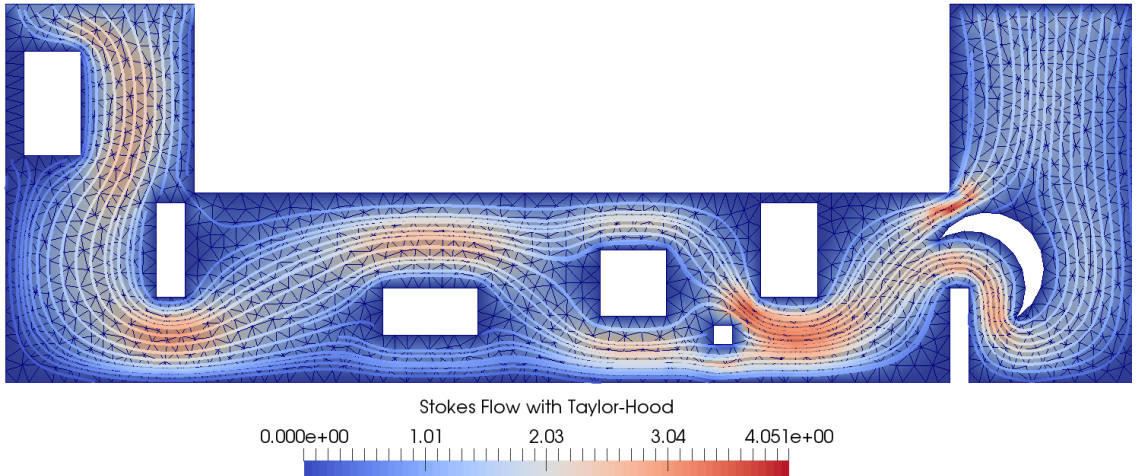


Stokes, with FeNics

DF

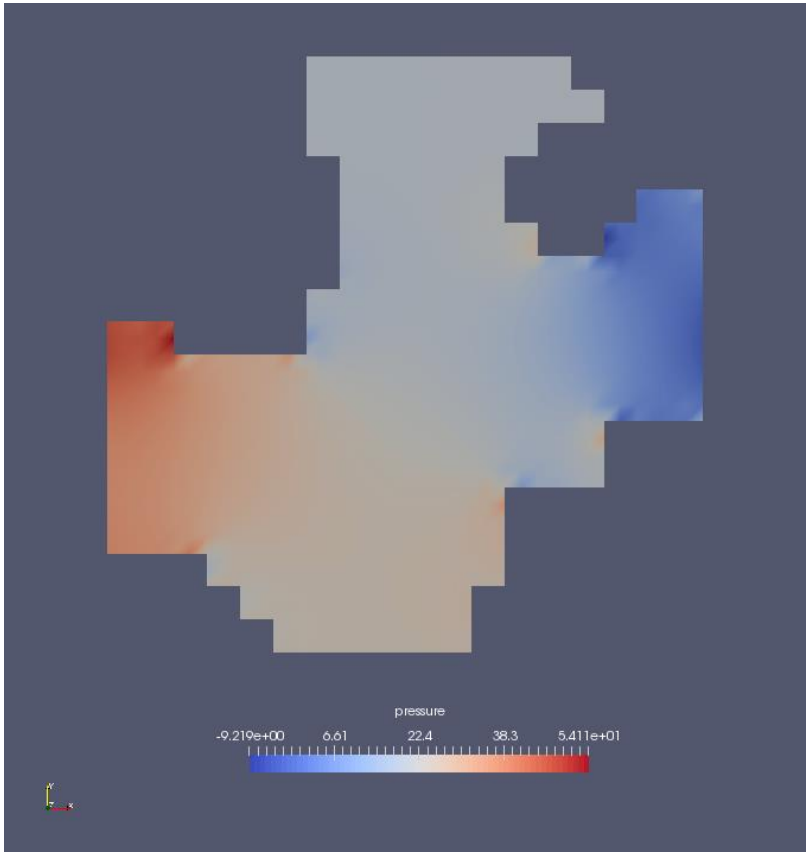


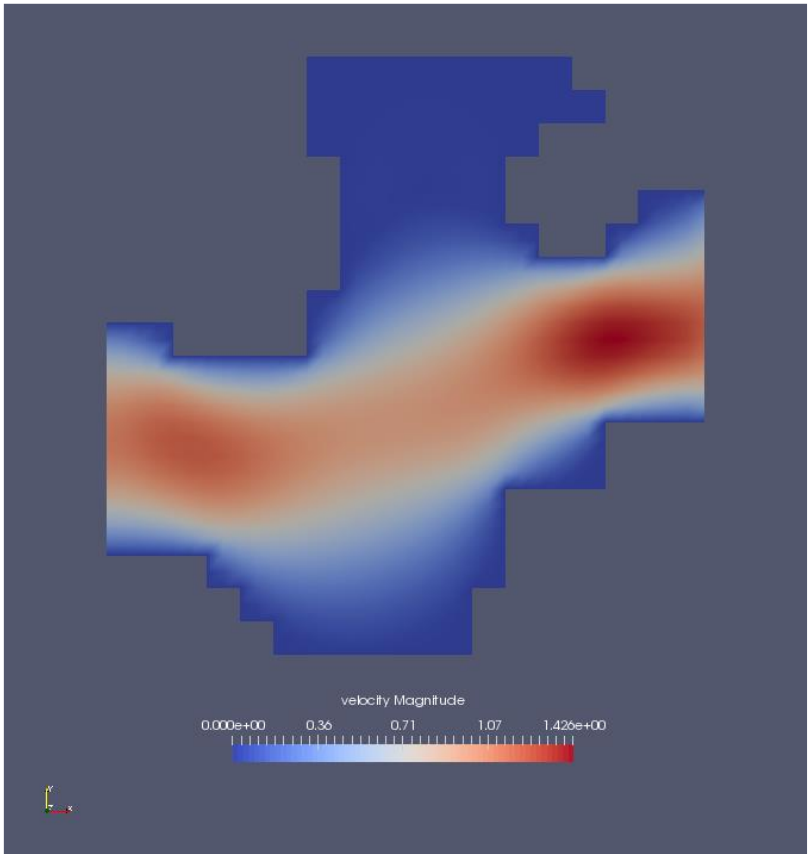




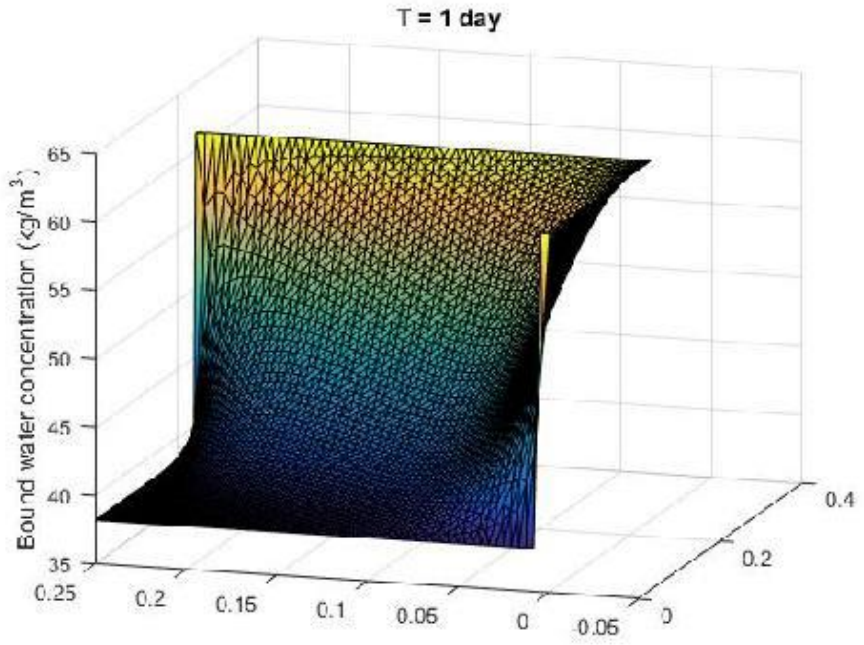
Stokes, with deal ii

JU





Complex physics model: bound water in wood engineering (diffusion with sorption)



DW

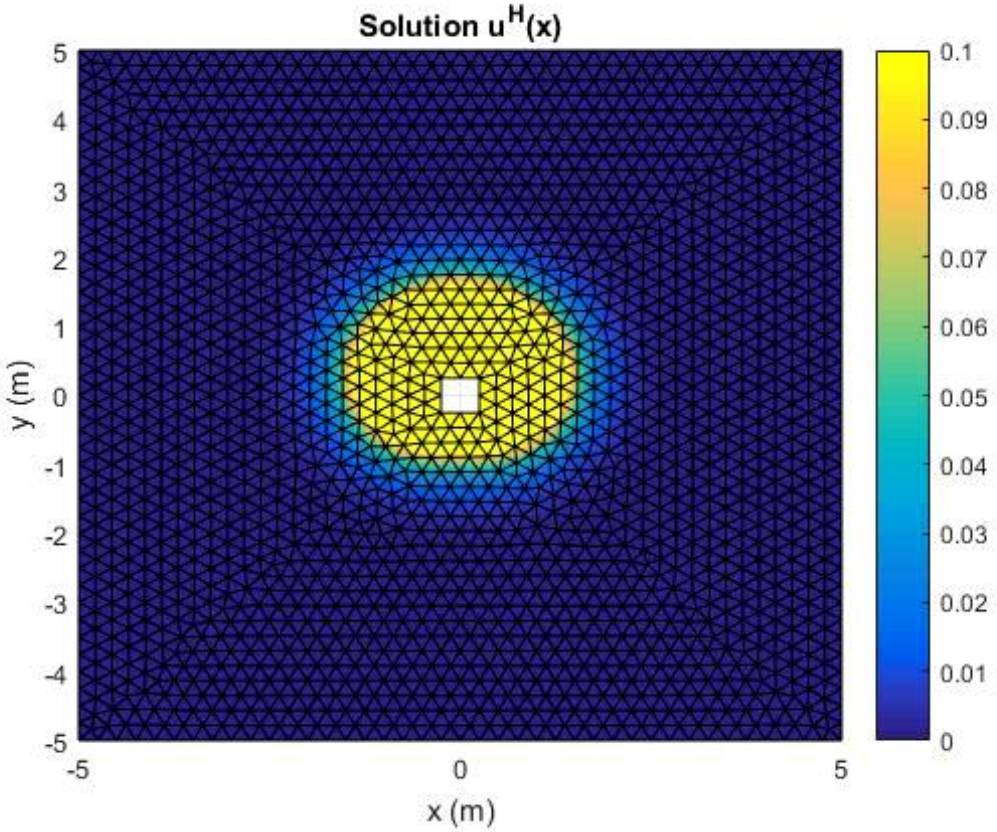
Figure 8. Bound water concentration profile after 2 days

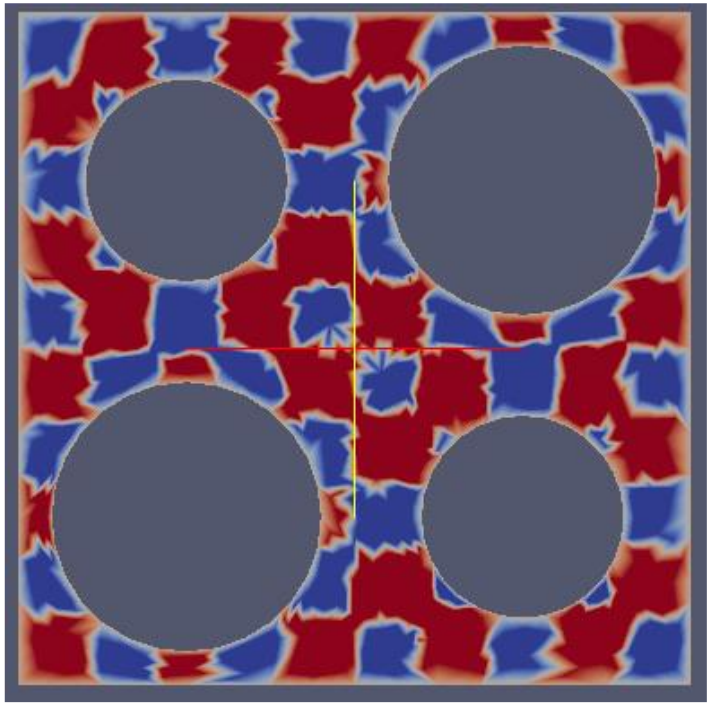
More complex physics: work in progress

$$(I + \eta A_\phi)\,\phi_t + A_\phi\,(\alpha(\phi) + P) = \nabla \cdot (1-\phi)\nabla\Delta^{-1}F,\ \phi(0) = \phi_0.$$

DH

Time dependent problems





ME/EH

SK

- Thanks for a great term and your hard work!