

Possible topics for a bachelor thesis

Lukas Einkemmer (Department of Mathematics, University of Innsbruck)

If you are interested in writing a bachelor thesis in any of the following topics

- **numerical analysis** (from interesting numerical algorithms to performing rigorous convergence analysis),
- **scientific and high performance computing** (from GPUs and supercomputers to the visualization of fluid flow),
- **modeling** (e.g. applying mathematics to solve problems from science and industry),

please contact me either by E-mail (lukas.einkemmer@uibk.ac.at) or in person. We can then discuss where your interests lie and chose an appropriate topic. The bachelor thesis can be written in either English or German.

Some possible suggestions for topics:

- what information does the Fourier transform give if only a subset of the signal is known (Nyquist limit, windowed Fourier transform, aliasing, etc.);
- numerical methods to solve linear systems of equations (in particular, iterative methods and preconditioners);
- how can we determine the equilibrium distribution in a fusion reactor;
- visualization of simulation results using VISLAB;
- numerical algorithms for solving partial differential equations;
- how do supercomputers work and what type of technologies & algorithms do they require.

In addition, here is a (selected) list of bachelor thesis topics that have been worked on in the past:

- Simulating fluid flow around airfoils.
- The alternating direction implicit numerical scheme for solving the heat equation.
- Adaptivity in numerical methods (i.e. how can a numerical algorithm automatically choose an appropriate time step size or grid spacing).
- The multi-body problem and how to numerically solve it on a computer.
- Kalman filter and their application to sensor fusion.