

## Fluid Dynamics

### Exam 2: Viscous and compressible flow

1. Forces in viscous fluid. Cauchy's theorem.
2. Derivation of the Navier-Stokes equations.
3. Energy dissipation. Decay of gravity waves.
4. Dimensional analysis.
5. Helmholtz decomposition.
6. Examples of viscous flows (Couette, Poiseuille, pipe).
7. Flow around a sphere for small  $Re$  (Stokes equations).
8. Stability of steady flow, turbulence (basic ideas).
9. Boundary layer. The Prandtl equations.
10. Boundary layer solution for a semi-infinite plate.
11. Separation of boundary layer.
12. Conditions for incompressible flow model.
13. Sound.
14. Characteristics and Riemann invariants in compressible flow.
15. Simple and rarefaction waves. Solution for a piston in a gas tube.
16. Shock wave.