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# Numerical methods for fluid mechanics, heat and mass transfer

**Lecturer: prof. Michael Dumbser**

**Timetable 2018 :**

February 2018	Hours	Room
Thursday 15 February	9:00 – 12:30 / 14:00 – 17:00	2A / PC OVEST
Friday 16 February	9:00 – 10:30/ 10:30-12:30 - 14:00-17:00	2A / PC OVEST

**Duration: 12 hours (1,5 ECTS)**

**Programme:**

## Thursday 15.2.

9:00-10:30 Numerical methods for the heat conduction equation and diffusion problems:  
 The forward in time central in space method (FTCS)  
 The backward in time, central in space method (BTCS)

10:30-11:00 Coffee break

11:00-12:30 Numerical methods for the linear scalar advection equation and nonlinear scalar conservation laws  
 The explicit upwind method for the linear scalar advection equation: discussion and analysis  
 The Riemann problem and the Godunov method for nonlinear scalar conservation laws

12:30-14:00 Lunch break

14:00-17:00 Practical computer laboratory exercises on numerical methods for convection and diffusion problems

## Friday 16.2.

9:00-10:30 Numerical methods for the incompressible Navier-Stokes equations  
 Discussion of the governing PDE  
 Semi-implicit schemes on staggered grids for the discretization of the incompressible Navier-Stokes equations with scalar transport and buoyancy forces due to temperature gradients

10:30-11:00 Coffee break

11:00-12:30 Practical computer laboratory exercises on semi-implicit schemes on staggered grids for the discretization of the incompressible Navier-Stokes equations with scalar transport and buoyancy forces due to temperature gradients

12:30-14:00 Lunch break

14:00-17:00 Practical computer laboratory exercises on semi-implicit schemes on staggered grids for the discretization of the incompressible Navier-Stokes equations with scalar transport and buoyancy forces due to temperature gradients

Test case: natural convection in a closed heated cavity with additional scalar transport

**Registration:** in order to access the course, please send an e-mail to [dicamphd@unitn.it](mailto:dicamphd@unitn.it)

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