Course A6 - part 1 : Analysis and discretization of transport equations

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Abstract:

The course is devoted to the analysis and numerical discretization of transport phenomena, namely scalar linear and nonlinear models: existence of strong and weak solutions, stability and convergence of numerical methods (either based on finite differences or finite volume methods).

- Modeling of transport phenomena.

- The method of characteristics in the linear case.

- The method of characteristics in the nonlinear case. Strong vs weak solutions.

- Finite difference approximations of transport equations.

- Finite volume methods.

Prerequisites:

Differential calculus; Basis of ordinary differential equations : theory and numerical approximations.

References:

R. LeVeque, *Numerical methods for conservation laws*, 2ème édition, Birkhäuser, 1990.

R. LeVeque, *Finite volume methods for hyperbolic problems*, Cambridge University Press, 2002.

B. Perthame, *Kinetic formulations of conservation laws*, Oxford University Press, 2002.

L. C. Evans, *An introduction to Partial Differential Equations*, American Mathematical Society, 2010.