UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Methods of Applied Analysis

2425-1-F4001Q115

Aims

According to the Mathematics Degree educational objectives, the course aim is the study of problems motivated by applications in physics, biology, economy, and social sciences.
The problems will be tackled starting from the modeling aspects and then developing analytical and numerical tools for their study.

Contents

Vehicular Traffic.

1. Microscopic models: *Follow the Leader* and extensions
2. Macroscopic models: LWR and $2x2$ systems
3. Road networks: junctions, traffic lights, roundabout ...
4. Control problems: traffic lights timings, autonomous vehicles...

Detailed program

1. Modeling using ordinary and partial differential equations.
2. Well posedness for ODEs.
3. Numerical methods for ODEs.
4. Method of characteristics.
5. Hyperbolic conservation laws.
6. Numerical methods for conservation laws.

Prerequisites

Knowledge of Analysis courses of the Bachelor degree.
Banach and Hilbert spaces. L? spaces.

Teaching form

64 hours of in-person, lecture-based teaching (8 ECTS)

Course delivered in Italian with the possibility of being delivered in English in case of request/presence of foreign students.

Textbook and teaching resource

- A. Bressan. *Hyperbolic systems of conservation laws: the one-dimensional Cauchy problem*. Vol. 20. Oxford University Press on Demand, 2000.
- L.C. Evans. *Partial differential equations*, American Mathematical Society.
- M. Garavello, K. Han, B. Piccoli. *Models for vehicular traffic on networks*, AIMS, 2016.
- R. J. LeVeque. *Finite volume methods for hyperbolic problems*, Cambridge University Press, 2002.

Semester

Second period.

Assessment method

Written examination. The student is asked to answer to some questions about the program. The answers must be precise, detailed, comprehensive and consistent with the topic.

Office hours

By appointment.

Sustainable Development Goals