

# Master Degree in Mathematics University of Verona

<http://www.univr.it/mathematics>

Department (of excellence) of Computer Science

a.y. 2018/2019

# Why mathematics?

## Economic repercussions of mathematics:

- UK Deloitte Report - Measuring the Economic Benefits of Mathematical Science Research in the UK (2012).
- Deloitte Report - Mathematical sciences and their value for the Dutch economy (2014).
- Rapport sur l'impact des mathématiques dans l'économie et la société française (2015) (15% PIB).

# Why mathematics?

Growing professional environments requiring strong mathematics skills:

- Life sciences, biology, health and medicine.
- Computer science in general, and HPC (High Performance Computing) and big data in particular (we have a cluster)
- Physics at all scales and engineering sciences. Material science.
- Social sciences, in the broadest sense. Development of complex systems or modelling and data analysis.
- Finance, insurance.

# Modelling Week 2016, Verona

## PhD Modelling Week, September 4-11, 2016 - Verona (Italy)



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### Home

Between September 4 and 11 2016, the joint *Diplomatic School of Mathematics* of the Universities of Trieste and Verona and the *Department of Computer Science* of the University of Verona organize a Modelling Week for PhD students. This event will take place at the Department of Computer Science and will gather PhD students in Mathematical Sciences from different European countries, together with academic supervisors and representatives from industry. This initiative was supported by COST action TD1406, Mathematics for Industry Network (M4IN2). Students work together in groups on projects defined and supervised jointly by academic and industrial cooperative partners, and they find out how mathematics contribute to the solution of currently relevant industrial problems.

A number of problems from various application contexts will be presented to participants and teams will be formed in order to tackle such problems during the week, under the supervision of an instructor. The goal is to understand the problems individually well in order to select the appropriate modelling and the possible approaches. Then the students will derive and numerically implement a solution, using GNU OCTAVE, MATLAB, C, C++ or other languages or packages. On Monday, the various teams will present their results to all the participants, inclusive industrial representatives. A final report on the assigned problems will be prepared by each group, within two months.

### Projects

#### 1) Simulation of Particle Accelerator Cavities (Instructor: Dr. Carlo De Falco, Milan Polytechnic)

Particle accelerators, such as the LHC at CERN, accelerate particles up to the speed of light by using a properly shaped electromagnetic fields. Radio frequency cavities are responsible for the acceleration of the beams. The fields created within these devices are extremely sensitive to the geometry of the cavity itself. A company in Sesto (Verona, Italy), for which the instructor does a specific consulting, constructs such particle accelerator cavities and needs highly reliable simulations of these fields in function of the geometry of the cavity to maximize their products for scientific laboratories. The problem is then, assigned different cavity geometries of interest, to appropriately represent the computational domains through Computer Aided Design (CAD) in order to run simulations of such systems. The instructor will suggest to the team to use isogeometric analysis tools, that allow the exact treatment of geometries defined by CAD even at the coarsest level of discretization refinement. The instructor will provide suitable teaching material to give an introductory overview of CAD geometries and isogeometric analysis through the illustration of basic examples, then the team will go through the application of these tools and concepts to the simulation of accelerator cavities having a prescribed geometry.

#### 2) Stress models and optimization models for the banking/industry sector. Instructors: Dr. Luca Di Persio, University of Verona, in collaboration with IASON Ltd (Dr. Michele Bredas), and in collaboration with Dr. Ben Pasetti



# Why in English?

- The official language of science is **English**
- More opportunities for **studying/research/job** both in Italy and abroad
- CLIL: English as mandatory teaching language in high school classes (C1 level required)
- Highly qualified international teaching staff

## Internships (some examples)

- Chiara, 2016, Google Summer of Code
- Cristiano, 2016, European Space Agency SOCIS
- Chiara, 2014, Camera di Commercio, Verona
- Andrea, 2014, Fairmat (software house and financial mathematics)
- Isacco, 2014, Aleph Energy (models for energy markets)
- Alessandro, 2014, Cattolica Insurance
- Cristina, 2013/14, Erasmus and internship, University of **Innsbruck** (Austria)
- Sara, 2011, French Institute of Petroleum, **Paris** (France)
- Gregorio, 2014, Enginsoft (Computer Aided Engineering)
- Elisa, 2012, Zamperla (roller coasters design), Vicenza
- Martina, 2013, Atraki (traffic flow modeling), Verona

# Job opportunities: alumni

- Matteo 2017, PhD, **Nice**
- Giulia 2016, PhD, **Nice**
- Greta 2016, Unicredit, Milano
- Silvia 2016, Intesa S. Paolo
- Gregorio 2015 Generali
- Franco 2016, PhD in Mathematics, Universities of Trento and Verona
- Giulia 2015, KPMG, Verona
- Chiara 2015, PhD **Innsbruck**
- Marcella 2014, internship and PhD in Applied Mathematics, University of **Sophia-Antipolis** (France)
- Simone, 2014, PhD in Applied Mathematics, **Cambridge** (UK)
- Davide, 2013 PhD in Computer Science, University of **Lugano** (Switzerland)
- Giulia, Elena, . . . 2013–15, PhD in Mathematics, Universities of **Trento and Verona**
- Marcello, 2013, analyst, Panrhema (financial advice), Milan
- Anna, 2013, business intelligence analyst, Deloitte, Milan
- Chiara, 2013, quantitative analyst, Almaiura, Verona
- Silvia, Andrea, . . . , 2012, high school teachers
- <http://www.univr.it/mathematics/alumni-ae>

# Curricula

## Common **foundational courses**

- Differential geometry
- Functional analysis
- Analytical mechanics
- Algebra



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  - Mathematical logic
  - Mathematics teaching and workshop
  - Mathematical methods for computer science

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- **Curriculum Applied Mathematics - core courses**
  - Partial differential equations
  - Advanced numerical analysis I and II
  - Stochastic differential equations
  - Optimization

## Elective courses: main tracks and tutors

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- I. seminar and mini courses delivered by international faculties
- II. courses from other masters in Verona (partially in Italian)
- III. courses in agreement with University of Trento
- IV. courses within Erasmus+ mobility program

Type III. or IV. courses may supersede foundational or core courses



## Further activities

- 1 semester (or 2) of mobility experience abroad (Erasmus+ & UniVR Worldwide programs)

Presentation of agreements to students: **December/January**

Deadline for first semester (a.y. 2019/20) abroad: **June/July**

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(<http://profs.scienze.univr.it/mathematics/internship>)
  - From interacting particle systems to kinetic equations
  - ECMI modelling week in Darmstadt

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  - From interacting particle systems to kinetic equations
  - ECMI modelling week in Darmstadt
- Final project (also **abroad** within Erasmus+ program)

# Information

- **Web page**  
<http://www.univr.it/mathematics>
- **Email**  
master.math@ateneo.univr.it or marco.caliari@univr.it
- **Facebook** page (managed by students' representatives)
- <https://goo.gl/mNzbS9>, calendar of mathematical activities (minicourses, meetings, ...), ask me for sharing