Escola de Inverno de Matemática

23rd February 2021

About ECMI

- Founded on June 26, 1987
- Dutch "stichting"
- Network of about 100 institutional members in 22 European countries and Israel

ECMI – Mission

In response to the needs of European industry to maintain its position as a world leader for high technology and to comply with the EU 2020 agenda for smart, sustainable and inclusive growth,

- ECMI advocates the use ofmathematical modelling, simulation, and optimization in industry
- ECMI stimulates the education of young scientists and engineers to meet the growing demands of industry
- ECMI promotes European collaboration, interaction and exchange within academia and industry

ECMI – Education

- Under auspices of ECMI Educational Committee
- More than 20 high-standard master programms in industrial and econo-mathematics
- Facilitate student exchange through synchronized local master programs
- Several ongoing collaborations between teaching centres, involving master and PhD students:
  - ModClim (modelling clinic for PhD students)
  - Virtual education (several online courses, available in a Moodle platform); ECMI Virtual Campus
  - BigMath (submitted for funding, under the Marie Curie program; Machine Learning PhD)

ECMI – Education

The aim of the ECMI Educational programme in Industrial Mathematics is to develop a student's mathematical and computational skills to solve industrial problems and development tasks in innovative ways.
Fundamental capabilities to be trained are:

- modelling and analytical skills,
- knowledge of numerical methods,
- skills in programming and simulation,
- experience with mathematical models in industry and/or economy,
- ability to handle huge amounts of data by integrating mathematical, numerical and statistical methods,
- team working, cooperation, communication with and presentations for mathematicians and engineers.

ECMI – Education

In order to achive such goals, an ECMI master should have

- Basic courses in Calculus, Linear Algebra, Numerical Analysis, Programming and Statistics
- More evolved courses on ODE's, PDE's, numerics for differential equations, data analysis
- Elective courses in industrial mathematics, comprising mathematical courses and a minor on applications
- Modelling activities, including seminars, summer schools, industrial projects, modelling weeks, etc
- Master thesis, related to a real industrial problem.

ECMI – Education

Technomathematics: covers subjects related to modelling of technical subjects as encountered in mechanics, pharmacy, electronics, chemistry, physics, bioengineering, civil engineering, biotechnology, etc.
Economathematics: deals with problems like e.g. planning and scheduling, operation analysis, quality control, statistics, distribution management, financial decision processes, data communication, etc.

The general policy is that the two branches have to be linked closely together. In any case, students from the different branches in the Programme must be able to *talk to each other*.

ECMI – Teaching Centres

- University of Kaiserslautern
- Technical University of Dresden
- Johannes Kepler University, Linz
- University of Milan
- Technical University of Eindhoven
- Technical University of Denmark
- University of Oxford
- University of Strathclyde
- Lappeenranta University of Technology
- Chalmers University of Technology
- Lund University
- The Norwegian University of Science and Technology
- University Carlos III of Madrid
- Sofia University "St. Kliment Ohridski"
- Wroclaw University of Science and Technology
- University of Lisbon – Instituto Superior Técnico
- University of Coimbra
- University of Novi Sad
- University of Verona
- University of Grenoble-Alpes
- Eötvös Loránd University

ECMI – Teaching Centres

ERASMUS student exchanges are easier within ECMI teaching centers

- Similar structure
- Close contacts with Coordinators
- Some of the are members of the CLUSTER

ECMI – Teaching Centres

In Portugal we have two teaching centers:

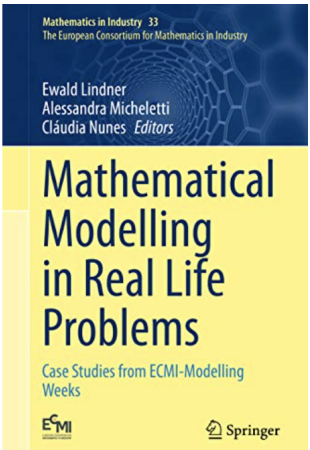
- IST, MMA
- University for Coimbra, Mathematics

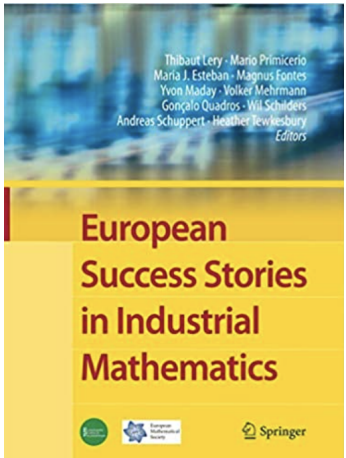
Both offer the branch of Technomathematics. We expect to have (good) news soon on some offer on Economathematics!

ECMI – Modelling Weeks

ECMI has been running annual Modelling Weeks for students since 1988. Students come from all over Europe to spend a week working in small multinational groups on projects which are based on real life problems. So far we had 35 Modelling Weeks (one virtual).

Last modelling week (non-virtual) was organized by Université Grenoble-Alpes.


Mathematics in Industry 33
The European Consortium for Mathematics in Industry
Ewald Lindner
Alessandra Micheletti
Cláudia Nunes Editors
Mathematical Modelling in Real Life Problems
Case Studies from ECMI-Modelling Weeks
ECMI
Springer


Thibaut Lery · Mario Primicerio
Maria J. Esteban · Magnus Fontes
Yvon Maday · Volker Mehrmann
Gonçalo Quadros · Wil Schilders
Andreas Schuppert · Heather Tewkesbury
Editors
European Success Stories in Industrial Mathematics
Springer

ECMI certificate

A diploma supplement awarded by ECMI, awarding students that have in their curricula modelling activities, international exchanges and a thesis written in English on an industrial subject.

The application of a student for the ECMI certificate is usually organized by the ECMI responsible at the student's home university. It includes the thesis in English language and a full transcript of studies and modelling activities relevant for the ECMI programme.

Only students enrolled in an ECMI Teaching Center, or in a provisional ECMI Teaching Center may apply for the certificate.

ECMI certificate

What do I need to do to apply for an ECMI certificate

- Enrol in the MMA
- ERASMUS exchange or Modelling Week, abroad
- Modelling activities
- Industrial thesis

ECMI– Industrial thesis

Examples (titles) from MMA

- Simulation of liquid emptying from horizontal and inclined tubes with Smoothed Particle Hydrodynamics, Numerical Analysis
- Structured Population Dynamics in a Real World Context, Dynamical Systems
- Study of the switching problem with abandonment option ? application to petroleum production, Probability and Statistics
- Modela da Despesa com Medicamentos nos Hospitais do Serviacional de Sade, Probability and Statistics
- Bayesian Generalized Additive Models for Car Insurance Data, Probability and Statistics
- A fluid-structure interaction model for the study of earthquake response in a dam-water system, Numerical Analysis

ECMI– Industrial thesis

Examples (titles) from ECMI Certification

- Optimal Control of a Melting Furnace, Tecnhnische Universitat Kaiserlautern (identification of an optimal flame geometry parametrization in the polyphosphate production process such that the energy consumption is minimized)
- A numerical study of fluid flow in peristaltic pumps and polymeric elastic pipes, University of Milano (proposal of a control of fluid flow for applications in Medecine and Engineering)
- Computational methods for beam angle optimization in intensity modulated radiotherapy, University of Coimbra (optimization problem related to the treatment of tumor forms, known as intensity modulated radiotherapy.)

ECMI– Industrial thesis

Examples (titles) from ECMI Certification

- Estimating parameters for a model of market dynamics and regime switching, University of Novi Sad (identification of different conditions on the financial markets, their analysis and forecasting)
- Classic and Kernel Principal Component applied to genomi data for cancer detection, University of Milano (comparison study of two diferent genomic technologies for measuring gene expression, whose goal is to detect and classify cells as normal or as affected with cancer basing the decision on their gene expression levels.)
- Simulation of liquid emptying from horizontal and inclined tubes with Smoothed Particle Hydrodynamics, IST (MMA) (study of a pipe emptying problem of an initially closed tube, in which one of its ends is suddenly opened and the liquid freely ows out from it.)

ECMI – Wacker prize

Wacker prize

For more information:

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- Visit ECMI webpage: https://ecmiindmath.org/