Minisymposium *ECMIMIM: Concepts of Mathematical Modelling in the Curriculum of Mathematics in Industry*

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Mathematics as a scientific field in conjunction with its large variety of applications turns out to be one of today's key skills. Products and processes of different kind are more and more developed and designed by means of mathematical modelling starting from the initial concept up to manufacturing and service. Hence, interaction with industry in the widest sense is a desirable aim for European studies in applied mathematics.

ECMI was founded with the aim to strengthen the collaboration between mathematical departments at European universities and the European industry and to promote the use of mathematical models in industry. The advantage is obvious for both sides: industry provides interesting real-life problems to train the student's skills in mathematical modelling and programming and on the other hand benefits from the expertise of the mathematicians in modern mathematical modelling methods and numerical solving techniques. As a feedback these collaborations generate demands for new methods, give impulse to new areas of research, and the industrial partners become aware what mathematics can do for them and, perhaps, start creating new tasks.

Interested in an appropriate education of students who in the future intend to work as mathematicians in industry, in the late 80s ECMI created a two-year postgraduate programme in Industrial Mathematics. The programme prescribes a number of core courses forming the basic knowledge every student of industrial mathematics should have and thus obligatory for them. Further it includes modelling activities and a study abroad at another ECMI university for at least one term. The modelling activities comprise a modelling seminar and the International ECMI Modelling Week. The remaining courses of the study can be chosen freely among a offered list of specialization courses. The programme finishes with a project placed in industry which is completed by a report written in English on the level of a master thesis. Graduates of this programme receive a certificate.

Up to now the implementation of the ECMI study programme varied considerably from ECMI node to ECMI node. Some universities implemented it

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as part of their two years master study, some as additional programme during the diploma study, others after the masters degree, e.g. as initial part of the Ph.D. study. At present the ECMI educational system certifies too few students, i.e. too few accomplish the complete programme. Reasons are several: the extra work load, too hard common core requirements, not enough awareness of the certificate in the European world of science and industry, and therefore not enough advantage for the student.

The aim of the new EU project "ECMI Model Master in Industrial Mathematics", a common project of 10 ECMI partners under the leadership of the University Carlos III of Madrid, is to establish an innovative model of a European master programme in industrial mathematics. The model curriculum shall prescribe the general structure of the master programmes on the basis of the existing ECMI study programme. All partners of the project implement their own local master programmes during the next years in such a way that they fit the general model curriculum but let special strengths of each university flow in. Via dissemination activities the idea of this common model master will be spread all over Europe to encourage other universities, in particular other ECMI nodes, to join this programme and establish corresponding master programmes.

The partners expect that such a master programme will much more attract students than the ECMI study programme could do sofar since it does not imply additional work load and is finished by an official degree with some international attribute. The compatibility of the local programmes under the cover of the model curriculum allows a fluent exchange of students. All partners can benefit from common expert knowledge by interchange of lecturers and a common e-course concept.

One essential part of the master curriculum is mathematical modelling. Hence, an important point of discussion forms the question about the educational concepts that are favorite to equip the students with

- Skills in the development of mathematical models and in analyzing them.
- Knowledge of numerical methods.
- Training in advanced programming and simulations.
- Experience in tackling real-life problems coming from industry.
- Experience in team work, in the communication with engineers and the presentation of results for mathematicians and people from industry.

The aim of the minisymposium was to discuss such concepts of mathematical modelling. Topics of the minisymposium were the concept of modelling competence, the importance of teaching continuous modelling during the study, in particular via e-courses, and the cooperation of universities and industry by forming common study groups.