# STATEMENT

## of the Partner Universities developing the

## European Master Programme in Industrial Mathematics[9]

### Dresden, September 10 - 11, 2009

The last decade in the European system of higher education was characterized by mutual effort and fresh ideas to create a unique European scientific and educational area based on the generalization and further development of best national experience in these fields gathered by all nation of Europe. The noticeable tendencies in higher education were inspired by the Bologna scheme and might be discribed by its common approach, comparability in the academic structure and scientific level as well as in the European scale of teaching and learning.

### General Feature and Objectives

- Mathematics, as a science together with the large variety of its applications, turns out to be one of the nowadays key technologies. Products and processes of different kind are more and more developed, designed, simulated and monitored by means of mathematical modelling starting from the first idea until manufactoring, prediction and service.

- The necessary scientific education and qualification for that purpose might be obtained by appropriate study programmes of Technomathematics or Industrial Mathematics offered by a large scale of universities in Europe. The need of such trained and qualified mathematicians in the industry and other branches of economy at present is very high and increases steadily.

- Very soon it was understood that the global orientation of industrial and commercial companies has to be reflected also in the academic education in order to train experts which are able to operate on this new level. So, in the late 80 s of the last century the European Consortium for Mathematics in Industry (ECMI) has established a very efficient system of coordinated training and education of experts in Technomathematics and, somewhat later, in Economathematics.

- Based on the close collaboration and the highly complex interaction between mathematics, engineering, natural sciences and informatics on the one hand and on problems from industry and technology on the other, there arise synergetic effects which have to be taken in consideration already during the education of the students. For that industrial practical training, special modelling seminars, and finally the master's thesis are appropriate tools.

- A technomathematician has a profound mathematical knowledge orientated on a broad spectrum of applications in the fields of engineering, technological and industrial problems and also of problems in natural and life sciences. The main area of his employment is characterized both by mathematical modelling and by analytic and numerical evaluation of the models very often with the help of computer facilities.

- The undersigned universities agreed to adopt the programme

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and offer it within the network from 2010 on. There is the intention to operate on a broad European scale by a compulsary student's exchange and by attracting other universities as well. An indispensable part are the annual international modelling weeks and summer schools, which bring together students from all participating universities for joint modelling and learning in small international teams. The common language is agreed to be English.

## Mathematics

- Mathematical models replace in many branches more and more experiments and laboratory trials; create virtual images of objects and systems, imaginary materials and artificial conditions; forecast system behaviour and analyse what-if situations as well as risk factors and failure mechanisms; optimize design parameters; manage and control large-scale information systems, networks and data-bases. So, all versions of the master's programme contain a large number of applied mathematical disciplines and interdisciplinary classes and activities.

- The modelling of *real life problems* has to be trained during the studies at the university, say in modelling seminars, workshops a. o. The best way to reach this is a close cooperation with the industry and other scientific research institutions, may be from outside the university.

- The topic of the master's thesis has to be derived from a problem with a direct practical background.

## Technology and Informatics

- The education of a technomathematician in the field of technology should be concentrated optionally on *one* engineering discipline, starting in the basic studies and continued in the master studies.

- The training in engineering sciences for technomathematicians has to be organized compulsary and jointly with the engineering students. This approach aims on the fact of an immediate communication of technomathematicians with engineers and other experts. So the student of technomathematics acquires not only the necessary knowledge and methods but also the vocabulary, the technical language and the way of engineering thinking in at least one branch of technology.

- For an effective simulation, optimization and control of technological, economical and other systems and processes the application and use of computers are indispensable. The computer is an efficient tool, which any technomathematician should be able to use optimally. For that he has to gain some knowledge in Informatics aimed at an professional use of computers.

## Interaction with Industry

- For an high-qualified education of technomathematicians direct research contact and cooperation of scientists of the Department of Mathematics with industrial enterprises are necessary and have to be involved into the education process.

- Via the engineering sciences many open and relevant technical problems flow in a natural way into the education. They have to be exploited consequently. However they can't substitute direct contacts with and practical training in the industry.

- Besides a high mathematical level in the master theses which finalize the two years study programme in Industrial Mathematics, some applied engineering, industrial or economic background should be visible.

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Universitat Carlos III de Madrid
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