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News European Mathematical Society

European initiative created to support applied and industrial mathematics

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On 27 November 2013 the Centre for Mathematics and Computer Science (CWI) in Amsterdam marked the launch of EU-MATHS-IN (European Service Network of Mathematics for Industry and Innovation) with a meeting that drew 46 participants from Europe and a visitor from Japan. EU-MATHS-IN was established to increase the impact of mathematics in science and industry and to foster the development of new modeling, simulation, and optimization tools. Amid lively and stimulating discussions, meeting participants formulated action items and established the core membership of associated working groups.

The discussions focused mainly on ways in which mathematics and mathematicians should interact with their partners in science, technology, and industry, in particular with those working in potential areas of application. Through many commonly used products and services, mathematics clearly affects the everyday life of most people in society. In contrast to that, there is a serious and growing concern about support for mathematics in programs that fund science. As a highly disturbing example, mathematics was not officially identified as a *Key Enabling Technology* in the official documents of the EU program Horizon 2020. References to this discrepancy are generally countered by the view that mathematics plays a role in many projects, and that the intended aim of the projects is not the development of particular disciplines, but rather the ability to face emerging challenges in science, technology, and society. As discussed at the meeting in Amsterdam, this perspective reflects substantial misunderstandings that need to be addressed in order to prevent rather serious negative consequences. In particular:

– In general, mathematics cannot be effectively applied without substantial involvement of mathematicians. Progress in computing technology alone, no matter how many processors are available, is not going to resolve the principal challenges in mathematical modeling and simulation. Progress in mathematics-based methodology is a strict requirement.
– Under the (false) assumption that the challenges identified *today* can be addressed by routine applications of state-of-the-art mathematical results, it may seem that ongoing development of mathematics as a discipline is not a priority that can be justified by economically measured efficiency. Precisely the opposite is true. Even more important, without such development: how will the challenges that emerge twenty years from now be met? Certainly not by routine black-box applications of decades-old mathematical results, petrified in the form of obsolete software.

Similar situations and the need to explain basic misunderstandings about the role of mathematics reappear in history again and again. Quotes from two prominent scientists, one from the nineteenth and the other from the twentieth century, help make the point. Henri Poincaré addressed the interaction of science and its applications in the following way [1]: "The scientist must not dally in realizing practical aims. He no doubt will obtain them", but in doing so must never forget that the object of his study is only part of the whole, which must be the

sole motive of his activity. "Science has had marvelous applications, but a science that would only have applications in mind would not be science anymore, it would be only cookery."

Surely, everyday applied cookery is needed; it should be highly valued and supported. But without science as understood by Poincaré, *mere cookery cannot survive more than a short period*.

The second quote is from a lecture titled 'Why Mathematics?' presented by Cornelius Lanczos in 1966 [2]: "There is no question that in view of the vastly expanded technology the applications of mathematics have multiplied. But the fields of applied mathematics remained in close contact with the traditional edifice, which is strong enough to serve as the basic superstructure."

Lanczos contributed to many areas of mathematics, as well as to physics, and, we can state without exaggeration that his methods (and the results of developments based on them) are used in many industrial applications *every day*. Not incidentally, Lanczos worked for several years in industry (the Boeing Aircraft Company in Seattle).

The point can be stated clearly. If current science-funding policy does not provide for continued building of what Lanczos called the basic mathematical 'superstructure', i.e., if the development of mathematics as a discipline will be severely restricted because of insufficient funding, then the applied mathematical tools needed to meet the challenges that will arise in various applications in the years to come will not be available. Consistent with the viewpoints of Poincaré and Lanczos, the health of the discipline requires that the development of mathematics go hand in hand with its applications.

Substantial involvement of mathematics and mathematicians in solving challenging application problems in industry and in society now will pay off not only in the form of possible intermediate financial profit, but also, even more substantially, in the development of tools for the future. If such involvement remains limited, everyone will pay the price. EU-MATHS-IN aims to contribute to the positive scenario in several ways. To reach its goals, it is ready to collaborate with similarly focused institutions and initiatives worldwide, in particular with SIAM and ICIAM. The first steps in establishing and fostering such collaboration have already been taken.

References

1 J. Mawhin, *Henri Poincaré, A Life in the Service of Science*, Notices of the AMS 52(9) (2005).

2 C. Lanczos, *Collected Published Papers with Commentaries*, North Carolina State University, Raleigh, NC, 1998.