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Methods of Mathematical and Computational Physics for Industry, Science, and Technology

Roderick V N Melnik and Frands Voss

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Many industrial problems provide scientists with important and challenging problems that need to be solved today rather than tomorrow. The key role of mathematical physics, modelling, and computational methodologies in addressing such problems continues to increase. Science has never been exogenous to applied research. Gigantic ships and steam engines, repeating catapult of Dionysius and the Antikythera `computer' invented around 80BC are just a few examples demonstrating a profound link between theoretical and applied science in the ancient world. Nowadays, many industrial problems are typically approached by groups of researchers who are working as a team bringing their expertise to the success of the entire enterprise. Since the late 1960s several groups of European mathematicians and scientists have started organizing regular meetings, seeking new challenges from industry and contributing to the solution of important industrial problems. In particular, this often took the format of week-long workshops originally initiated by the Oxford Study Groups with Industry in 1968. Such workshops are now held in many European countries (typically under the auspices of the European Study Groups with Industry—ESGI), as well as in Australia, Canada, the United States, and other countries around the world. Problems given by industrial partners are sometimes very difficult to complete within a week. However, during a week of brainstorming activities these problems inevitably stimulate developing fruitful new ideas, new approaches, and new collaborations. At the same time, there are cases where as soon as the problem is formulated mathematically, it is relatively easy to solve. Hence, putting the industrial problem into a mathematical framework, based on physical laws, often provides a key element to the success. In addition to this important first step, the value in such cases is the real, practical applicability of the results obtained for an industrial partner who presents the problem. Under both outlined scenarios, scientists and mathematicians are provided with an opportunity to

challenge themselves with real-world problems and to work together in a team on important industrial issues.

This issue is a result of selected contributions by participants of the meeting that took place in the Sønderborg area of Denmark, one of the most important centers for information technology, telecommunication and electronics in the country. The meeting was hosted by the University of Southern Denmark in a picturesque area of Southern Jutland. It brought together about 65 participants, among whom were professional mathematicians, engineers, physicists, and industrial participants. The meeting was a truly international one, with delegates from four major Danish Universities, the UK, Norway, Italy, Czech Republic, Turkey, China, Germany, Latvia, Canada, the United States, and Finland.

Five challenging projects were presented by leading industrial companies, including Grundfos, Danfoss Industrial Control, Unisensor, and Danfoss Flow Division (now Siemens). The meeting featured also the Mathematics for Industry Workshop with several distinguished international speakers. This volume of *Journal of Physics: Conference Series* on `Methods of Mathematical and Computational Physics for Industry, Science, and Technology' contains contributions from some of the participants of the workshop as well as the papers produced as a result of collaborative efforts with the above mentioned industrial companies. We would like to thank all authors and participants for their contributions and for bearing with us during the review process and preparation of this issue. We thank also all our referees for their timely and detailed reports. The publication of the proceedings of this meeting in Denmark was delayed due to problems with a previous publisher. We are very grateful that *Journal of Physics: Conference Series* kindly agreed to publish the proceedings rapidly at this late stage.

As industrial problems become increasingly multidisciplinary, their successful solutions are often contingent on effective collaborative efforts between scientists, mathematicians, industrialists, and engineers. This volume has provided several examples of such collaborative efforts in the context of real-world industrial problems along with the analysis of important physics-based mathematical models applicable in a range of industrial contexts.

Roderick V N Melnik, Professor of Mathematical Modelling, Syddansk Universitet (Denmark) and Professor and Canada Research Chair, Wilfrid Laurier University, Waterloo, Canada E-mail: rmelnik@wlu.ca

Frands Voss, Director of the Mads Clausen Institute, Syddansk Universitet (Denmark)