

Preface

This book is the post-proceedings of the Forum “Math-for-Industry 2013,” the focus of which was “The Impact of Applications on Mathematics.” This phrase represents an appropriate framework in which to highlight how real-world problems, over the centuries and today, have influenced and are influencing the development of mathematics and, thereby, how mathematics takes up the consequences of such impacts to advance mathematics for the benefit of mathematics and its applications. It is this process that underlies not only the key role that Mathematics-for-Industry plays in fostering productive and successful interaction between industry personnel and mathematicians, but also the cross-fertilization and collaboration that it stimulates in having mathematics involved with the advancement of science and technology.

The various chapters of this volume illustrate different aspects of how, starting with an inquiry or question from industry, there is a logical sequence of conceptualization and model formulation central to the resulting mathematical decision making that focuses on answering a question for the benefit of industry. The question under examination about the industrial problem focuses and drives how the associated mathematics must be unraveled, since there is no uniqueness in the ways that a specific mathematical model/construct/equation can be utilized.

Even when the industry problem leads to standard mathematics, there is an “impact.” To answer the question raised by the application, the appropriate interpretation of the mathematics within the context of the application must be identified. This is directly reflected in the fact that the same basic mathematical equations arise in quite unrelated applications.

The impact on mathematics from or by applications is universal. If one goes back into the history of mathematics, one finds that practical problems (applications) played a crucial role in its early development. This is true even today for much of mathematical research. Even within pure mathematics, which quite often possesses highly abstract components, this fact has validity in that one aspect of mathematical research is the identification of (e.g., simpler, constructive) proofs, which unveil the hidden secrets of mathematics and the significance of classical results.

The nature of the interaction is aptly summarized in the following comment by V. I. Arnold: “My best pure mathematics was in applied mathematics and my best applied mathematics was in pure mathematics.”

The chapters of this volume discuss the following aspects: specific examples of how the answering of a question, coming from industry, engendered new mathematical activity; how the same mathematics is central to the solution of quite different applications; how the answering of an industrial question requires deep thought about the essence mathematically of the application from which it came; how mathematics has built on the mathematics initially coming from the needs of applications; and how to foster young researchers in this vision.

From a Mathematics-for-Industry perspective, an equally important role of the Forum is the choice of topics, which engage and mentor all students of mathematics, pure and applied, about the nature of mathematics as real-world and social activities. From this point of view, we have held the Forum “Math-for-Industry” (FMI) annually from 2009, as readers can see in the short history of 5 years shown in the illustration following this Preface. A key goal is to foster and motivate participants’ professional involvement with industrial mathematics as a source of interesting real-world problems for which new mathematical perspectives are required and from which new research themes may even materialize, as a source for internship topics for students involved with collaborative projects with industry, and as a source for research subjects for graduates studying for a higher degree (M.Sc. or Ph.D.). In this way, all mathematics students have their eyes opened to the opportunities for all aspects of mathematics to contribute to the solution of real-world problems in terms not only of assisting industry but also of advancing the consequential impact on the development of new understanding about and opportunities for mathematics.

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Masato Wakayama
On behalf of the Organizing
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