

## Preface

This volume contains the proceedings of the workshop for graduate students on *Mathematical Modeling in Industry* that was held at the Institute for Mathematics and its Applications (IMA) at the University of Minnesota in Minneapolis from July 22 to July 31, 1998. The workshop, the fourth one convened at IMA, brought together 34 mathematics students from graduate programs across the country for an intensive 10-day modeling experience associated with industrial problems. The students were divided into six teams, each working under the guidance of an experienced industrial researcher who was asked to pose a real-world problem that their companies need to resolve. It was our belief that assigning five to six students to each group would allow for efficient work division among the members while still being conducive to team work. This, however, meant that we were faced with the challenge of selecting the participants from a wide pool of excellent applicants. A number of different criteria (including, for instance, geographic diversity) were used in this selection process so that our having to decline some applications was not necessarily related to the applicants qualifications. In fact, we hope that these students will preserve their desire to engage in this kind of experience and that many others will be encouraged to participate in the future.

As we expected (and, in reality, as we desired) the problems that were proposed to the students were not the neat, well-defined academic exercises found in classrooms, but rather they consisted of stimulating open-ended industrial pursuits. In most cases, the problems required new insight for their formulation and solution. The students spent ten days working on the problems and were asked to present their results orally on the last day of the workshop. In addition, the teams prepared written reports which we have collected for this volume.

The problems that were tackled during the workshop represent a very broad spectrum of mathematical areas and applications, as can be seen from the following list of presenters and topics:

- **Len Borucki** (MOTOROLA), *Chemical/Mechanical Planarization in Semiconductor Manufacturing*
- **John Hoffman** (SECURE COMPUTING), *A Problem in Computer Security*
- **Shirley Min** (MEDTRONIC), *Computer Simulation of Intracardiac Electrogram Sensing*
- **David Misemer** (3M), *Modeling Crystal Growth*
- **Craig Poling** (LOCKHEED MARTIN), *Mathematics in GPS*
- **Samer Takriti** (IBM, Watson Research Center), *A Unit Commitment Problem in the Energy Industry*

While reviewing the reports that follow, the reader will recognize the importance in industrial research of some classical areas of mathematics, including logic, probability and statistics, fluid and solid mechanics, potential theory, optimization and numerical analysis. In spite of the short time span of the workshop, the reports illustrate that substantive progress was achieved on all problems. This assessment was indeed shared by the problem presenters who came away with useful input from the students work. As for the students the most common response to our exit survey was that “it was a great learning experience”.

We would like to thank, first and foremost, the students and the industry presenters. The students were highly motivated and kept good humor in spite of the hard work and lack of sleep.

We are particularly grateful to the industry mentors for taking time to work closely with the students and for keeping them focused on the problems. The staff of the IMA deserves special mention for making the workshop successful (and easy for the organizers). Finally, we would like to thank Avner Friedman for his help in providing advice and guidance to the students.

**Fernando Reitich**

**Fadil Santosa**

*Organizers*

September 1998