Tenth PIMS Industrial Problem Solving Workshop

Simon Fraser University
June 26–30, 2006

IPSW

Connecting industry to solutions

PIMS

40 YEARS
SIMON FRASER UNIVERSITY

Mathematics Workshops with Industrial Impact

Mathematical study groups have evolved and spread around the world since their inception in Oxford in 1968. The basic format is that academics nucleate into teams to model and analyze problems brought forward by industrial companies.

The goal is to provide companies with useful ideas and tools to solve specific problems.

Event Format

Monday

In the morning, problems (usually 4–6) are presented by researchers working in industry. The afternoon is spent with the university researchers (typically about 50) dividing into groups and brainstorming on the different problems.

Tuesday–Thursday

Groups work on each problem. Mathematical models are formulated, analytical and computational techniques applied and recommendations are formulated.

Friday Morning

The problem-solving teams make presentations of their models and results to all participants.

Afterwards

Each team prepares a short written report of their progress made during the week, with special emphasis on end-user applications.

Benefits for Industry

Companies are invited to propose problems to be addressed at the study group. Once mathematical models have been made, their solution is obtained through both analytical and computational techniques. The practical consequences to you are always considered.

The primary benefits to your company are:

- Exposure to a network of international experts in mathematical modelling.
- Develop employment opportunities through contact with highly talented and qualified graduate students.
- Fresh insight into difficult problems that may give innovative solutions or ideas for new directions.
- Develop long-tem collaborations with academia for follow-up research.
- Raise your company's profile within the broader academic community.

Additionally, you will receive a professional quality written report prepared as part of the conference proceedings.

Research Areas

Past study group problems have come from manufacturing, engineering, financial, information technology and pure research firms. Solutions have been obtained using a wide variety of continuous, discrete and statistical analyses as well as direct computation.

Previous Case Studies

1) Statistical Design of Experiments

The Michelin tire company is interested in manufacturing tires that meet a certain level of uniformity. The more uniform the tire the smoother and quieter the ride. Uniformity is evaluated by measuring the force exerted by the tire exerted on a measuring device as it makes one revolution about its axle.

Non-uniformities can appear because each tire is made of as many as twenty layers, each with seams at different locations. In order to satisfy contractual obligations, Michelin needs to meet certain standards on uniformity. The problem is how to choose how the seams from the different layers can be best aligned. An experiment was designed to allow technicians to determine the contribution of each layer to the force curve.

Results

- A general model for the tire force curve was developed.
- This was solved with computational and analytical techniques.
- Statistical confidence of the experiment was quantified.
- Analysis was performed on the impact of faulty experiments

This work directly contributed to a simplified design process and significant savings for the company.

Previous Case Studies

2) Modelling Crystal Growth

Firebird Semiconductor is a small manufacturing company producing crystal wafers for the semi-conductor industry. A skilled employee carefully controls the manufacturing process in order to produce crystals that meet certain design requirements.

In order to enhance their manufacturing procedures, Firebird asked the study group to develop a model of the crystal growth process.

Results:

- A general mathematical model describing the mechanical, thermal and fluidic process was developed.
- Components of the model were analyzed in various physical regimes to give insight into the entire process.
- Recommendations on changes to Firebird's existing procedure were made.

This work lead to an ongoing research collaboration between the company and the participating academics to explore both manufacturing issues and fundamental scientific research.

Past Participants

A brief list of past participants includes: Boeing, IBM, Microsoft, Merak Projects, Searle Pharmaceuticals, Firebird Semiconductors, Michelin Tire, MacMillan Bloedel and the Canadian Communications Security Establishment.

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More information about this and previous years events can be found at:

www.pims.math.ca/ipsw

This event is organized by the Pacific Institute for the Mathematical Sciences.

Pacific Institute for the Mathematical Sciences

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