数学与系统科学研究院

计算数学所学术报告

报告人： **Prof. Hans-Jakob Lüthi**

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报告题目：**Optimization at Work: From Timetables for Railways towards Market Design for Emission Trading Schemes**

邀请人： 戴彧虹研究员

报告时间：**2010** 年 **7** 月 **28** 日（周三）

下午 **3**：**30**

报告地点： 晨兴数学中心

一层 **110** 报告厅

Abstract：

The focus of this lecture is to apply sound optimization concepts to socially relevant problems. After an introduction into the organizational structure of IFOR with its research strategy and some of its current projects I would like to present to applied projects done in collaboration with industrial partners in more depth:

The first one concerns the design of "robust" timetables for the Swiss Federal Railways (SBB) where the innovation lies on building a coherent computational framework to integrate a macroscopic global view of timetabling (global interdependencies of train schedules) with a microscopic local view where the train dynamics and the details of the railway infrastructure are considered. The computed timetables are detailed enough to guarantee a conflict-free routing of the trains while respecting both commercial goals (periodicity, connectivity, etc.) and safety aspects. In particular, to facilitate the detailed complex planning in the bottlenecks, we enhanced the well-established Periodic Event Scheduling Problem (PESP) by introducing a concept of flexibility. This new concept (Flexible PESP) yields a useful measure of robustness for the schedule on the macroscopic level. Even though all instances of the underlying scheduling problems are NP-hard we managed to come up with a computationally "tractable" timetabling system due to a tailored modeling framework and relying on recent and new developments in combinatorial optimization. (Joint work with M. Laumanns, G. Caimi, M. Fuchsberger, S. Wiedersheim).

In the second part I will present a project on the stochastic price formation of CO_2 allowances in a cap and trade system such as the European Union Emission Trading Scheme (joint work with M. Fehr, J. Hinz and R. Carmona).

In particular the following questions will be addressed:

- Relation of allowance prices to fundamental price drivers such as stochastic production costs and demand
- Equilibrium price formation of goods whose manufacturing causes pollution
- Emergent systems properties such as windfall profits in relation to alternative market design like carbon tax, auctioning of allowances, relative allocation schema, etc.
- Computational tractability and verification of the quality of approximate solutions using abstract duality theory.

The core of the presentations is based on the PhD-thesis by G. Caimi (http://www.ifor.math.ethz.ch/publications/diss_caimi) and M. Fehr (http://www.ifor.math.ethz.ch/publications/diss_fehr)

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