Risk-Averse Optimization

In recent years, there has been a surge of research activities on new mathematical models and methods of optimization of stochastic systems under high uncertainty and risk.

We concentrate on novel optimization models involving stochastic ordering constraints and risk functionals. This approach captures the entire distribution of outcomes, including events of small probability but high consequences, rather than just the average performance. By the use of stochastic orders and risk functionals the solutions gain additional robustness with respect to unknown preference structures and unknown distributions. Such robustness cannot be achieved within the existing framework of expected value optimization by stochastic dynamic optimization or multistage stochastic programming. The risk-averse models constitute a new mathematical structure and call for new theoretical development and dedicated numerical methods.

Specific topics addressed in this session involve:

- mean–risk models and their consistency with stochastic orders
- multi-period measures of risk
- stability of dominance-constrained optimization problems
- dynamic optimization with multivariate stochastic dominance constraints

The area of risk-averse optimization has a substantial and diverse impact on science, engineering, and economics. It will provide a qualitative advance in medicine, energy production and distribution, military problems, telecommunication, insurance and finance, and many other areas involving decision-making in dynamic stochastic systems under high uncertainty and risk.