Preliminary Program

Summer School on "Modelling, Simulation and Optimization for Energy Networks"

Wednesday, June 8th, 2022

3.00 pm: Falk Hante (HU Berlin)
*"Introduction to Mathematical Modelling, Simulation and Optimization using
the Example of Gas Networks"*

3.45 pm: Frauke Liers (FAU Erlangen-Nürnberg)
"Introduction to Robust Optimization"

4.30 pm: Holger Heitsch (WIAS Berlin)
*"An algorithmic approach for solving optimization problems with
probabilistic/robust (probust) constraints"*

Discussion with the Speakers (15min)

Thursday, June 9th, 2022

10.00 am: Falk Hante (HU Berlin)
"Introduction to Optimal Control"

11:00 am: Michael Schuster (FAU Erlangen-Nürnberg)
"Probabilistic Constrained Optimization on Gas Networks"

Discussion with the Speakers (15min)

12:00 am - 1:00 pm: Break

1.00 pm: Olivier Huber (WIAS Berlin)
"Nash Equilibrium Problems"

1.45 pm: Rico Raber (TU Berlin)
"Packing under convex quadratic constraints"

Discussion with the Speakers (15min)

3.00 pm – 3.15 pm: Break

3.15 pm: Industrial Talk by Maxime Grangereau (EDF, Électricité de France)
"tba"

Discussion with the Speakers (15min)

4.30 pm: Falk Hante (HU Berlin), Frauke Liers (FAU Erlangen-Nürnberg)
"Closing"

Abstracts

Holger Heitsch (WIAS Berlin)
"An algorithmic approach for solving optimization problems with probabilistic/robust (probust) constraints"

Presented is an adaptive grid refinement algorithm to solve probabilistic optimization problems with infinitely many random constraints. Using a bilevel approach, inequalities that provide most information not in a geometric but in a probabilistic sense are aggregated iteratively. For this conceptual idea convergence can be proven and an adapted implementable algorithm is presented. The efficiency of the approach is shown for a water reservoir problem with joint probabilistic filling level constraints.

Michael Schuster (FAU Erlangen-Nürnberg)
"Probabilistic Constrained Optimization on Gas Networks"

Uncertainty often plays an important role in gas transport and probabilistic constraints are an excellent modeling tool to obtain controls and other quantities that are robust against perturbations in e.g., the boundary data. We consider both, a stationary and a dynamic gas transport model with uncertain boundary data on networks. We provide an efficient way to compute the probability that random boundary data is feasible. In this context feasible means that the pressure corresponding to the random boundary data meets some box constraints at the network junctions. Further we consider and analyze optimization problems with probabilistic constraints in the stationary and the dynamic setting. The probabilities are computed using the spheric radial decomposition and a kernel density estimator approach. Last we compare the solutions of the probabilistic constrained optimization problems with the solutions of the corresponding deterministic problems.

References
[1] M. Schuster, E. Strauch, M. Gugat and J. Lang (2021) Probabilistic Constrained Optimization on Flow Networks, Optim. Eng. (2021), https://doi.org/10.1007/s11081-021-09619-x.
[2] M. Schuster (2021) Nodal Control and Probabilistic Constrained Optimization using the Example of Gas Networks, Dissertation, FAU Erlangen-Nürnberg, Germany, 2021, https://opus4.kobv.de/opus4-trr154/frontdoor/index/index/docId/410.

Rico Raber (TU Berlin)

"Packing under convex quadratic constraints"

We consider a general class of binary packing problems with multiple convex quadratic knapsack constraints. We present three constant-factor approximation algorithms based upon three different algorithmic techniques:

      (1) a rounding technique tailored to a convex relaxation in conjunction with a non-convex
          relaxation;
      (2) a greedy strategy;
and
      (3) a randomized rounding method.

The practical performance is tested by a computational study of the empirical approximation of these algorithms for problem instances arising in the context of real-world gas transport networks.