

# Nonlinear Optimization in Gas Networks

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**Abstract:** A routine task of every natural gas provider is the short-term (operative) planning of the load distribution in the pipeline network to satisfy the current demand. Variable operating costs are dominated by the energy required for the gas transport; thus minimizing the cost requires sophisticated control strategies for the technical equipment. Mathematically this leads to highly dimensional mixed-integer optimization problems involving various physical, technical, and contractual restrictions.

Due to the enormous complexity of the overall problem we pursue a hierarchical solution approach. Binary decisions are determined by mixed integer linear programming using crude approximations of the nonlinearities; continuous control variables are then optimized using a nonlinear control problem with fixed combinatorial decisions. The lecture concentrates on the modeling and numerical solution of the latter problem, addressing in particular the hyperbolic system of partial differential equations governing the gas flow and the nonlinear behavior of compressors described by characteristic diagrams. Numerical optimization results will finally be presented.

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