Optimal control of gas network DAEs

Henning Sauter (HU Berlin), Caren Tischendorf

R 3.28 Mon Z2 14:50-15:15

The physics in a gas flow network can be described by the Euler equations. In case that the temperature of the gas is assumed to be constant, a simplified model (ISO-2) can be derived. Additional algebraic restrictions such as bounds on the pressure and flow can be added yielding an overdetermined PDAE system. While the efficient and accurate simulation of the network is interesting in its own right, a more challenging aspect is to consider optimal control problems on these networks.

Typically, these problems are solved using either a *discretize-then-optimize* or an *optimize-then-discretize* approach. We demonstrate a novel approach consisting of 1. *discretize-in-space*, 2. *optimize*, 3. *discretize-in-time*. Firstly, a suitable spatial discretization scheme is used resulting in a DAE system of the network. Subsequently, we use an adjoint calculus approach to obtain the *optimality DAE*, which is then in turn discretized in time to obtain a solution both for the network state and the optimal control.

We demonstrate the procedure, comment on the connection of the optimal control problem and the optimality DAE and show a few numerical results.