Stabilization of Energy Networks governed by Linearized Hyperbolic Balance Laws

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Physical systems such as gas, water and electricity networks are usually operated in a state of equilibrium and one is interested in stable systems, where small perturbations are damped over time. We will consider gas flow on a network with feedback boundary conditions. We focus on isothermal Euler equations that are diagonalizable with Riemann invariants and analyze the stability of a steady state. Explicit conditions are presented yielding an exponential Lyapunov stability. We will focus both on a Lyapunov function with respect to the L^2- and H^2-norm. Furthermore, not only the convergence to a steady state of the analytical solution, but also of the numerical approximation is guaranteed. Numerical results illustrate our analysis.

References

[1] G. Bastin and J.-M. Coron, *Stability and Boundary Stabilization of 1-d Hyperbolic Systems*, Birkhäuser (2016)

[2] S. Gerster, M. Herty, *Discretized Feedback Control for Systems of Linearized Hyperbolic Balance Laws*, MCRF, Vol. 9, No. 3 (2019)