

Multiphysical Modeling and Numerical Simulation of Flow Networks

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We discuss a multiphysical modeling of electric networks, gas networks, and water distribution networks. Depending on the network topology and the modeling level, we obtain a system of differential equations, differential-algebraic equations, partial differential equations or couplings thereof. We present qualitative and structural properties of these systems and their effects onto the numerical simulation. In particular, we will show that the numerical results do not only depend on the type of the differential equation system and the choice of the numerical method but also significantly on the model formulation. Finally, we address problems to be solved for a successful and robust simulation of such systems concerning linear solvers, nonlinear solvers, numerical methods and the automatic generation of the model equations.