On Numerical Simulation of 1D Problems Describing Transport Processes in Li-Ion Batteries

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The modelling approaches for transport processes in Li ion batteries are presented in a companion talk in this special session. This talk concentrates on the numerical simulation of 1D problems. In order to numerically solve the resulting highly nonlinear coupled equations for ion concentrations, ion flux and electrical currents, numerical algorithms based on different versions of the Newton algorithm, the combined Newton-Picard algorithm, or the nonlinear multigrid method, are developed. A special challenge is the treatment of the nonlinear Robin like boundary conditions due to the Butler Volmer reaction kinetics at the interface of electrolyte and active particles. The performance of the numerical algorithms is studied in detail, and influence of different parameters on the convergence is numerically studied.