Improvement of accuracy of multi-scale models of Li-ion batteries by applying operator splitting techniques

Abstract:
In this work operator splitting techniques have been applied successfully to improve the accuracy of multi-scale Lithium-ion (Li-ion) battery models. A slightly simplified Li-ion battery model is derived, which can be solved on one time scale and multiple time scales. Different operator splitting schemes combined with different approximations are compared with the non-splitted reference solution in terms of stability, accuracy and processor cost. It is shown, that the reverse Strang-Marchuk splitting combined with the implicit scheme to solve the diffusion operator and Newton method to approximate the non-linear source term can improve the accuracy of the commonly applied vertical (sequential) multi-scale models by almost 3 times without considerably increasing the processor cost.

URI:
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Publication Year:
2017
Science Areas:
Energy and transport

Keywords:
battery
modelling

Publisher:
ELSEVIER SCIENCE BV
ISSN:
0377-0427
DOI:
10.1016/j.cam.2016.03.029