

# Parameter Estimation in a Single Particle Model Using COMSOL Multiphysics® Software and MATLAB® Optimization

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## Abstract

When it comes to study the behavior of the secondary batteries, physics-based models are more representative of the real behaviour than equivalent circuit models, especially for the estimation of the life and capacity fading. On the other hand, the complexity and computational cost of sophisticated physics-based models like pseudo two-dimensional (P2D) models justify the use of more simplified models such as single particle model (SPM).

Here, COMSOL Multiphysics® software was used, including the Single Particle Model for Lithium-Ion Batteries (Model ID: 14527), which was linked to MATLAB® software through LiveLink™ for MATLAB® and a regression technique was applied to estimate the parameters of the model. Moreover, an empirical equation for solution phase resistance was introduced to account for concentration and potential influences of solution phase at higher applied currents. This new equation was assessed with the same procedure as the one used for estimating parameters and fitting with P2D model.