

鋰電池建模，實作與可變結構控制

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摘要

本文利用狀態空間識別理論，建立一個全新的鋰電池模型，依據這個新模型，建立一個以參考模型(reference model)與可變結構控制器(variable structure control)為基礎的磷酸鋰鐵(LiFePO₄)電池充放電管理方法。經由Matlab/Simulink之模擬，本研究使用狀態空間方程式來描述磷酸鋰鐵電池的充電與放電過程特性，Matlab的曲線擬合工具(curve-fitting tool)被用來獲得部分電池參數。本法之模擬結果接近於實驗結果，電池充放電模組能夠適切地描述鋰電池特性，而且非常適合於現代控制理論之應用。根據實驗結果顯示，本文所採用的方法，可作為磷酸鋰鐵電池以及其他種類電池之建模參考。本研究之結果除了有助於新電池的建模和特性研究外，也可以運用於串聯電池組之相關研究。最後，考慮磷酸鋰鐵電池不確定成分特性的干擾，本文利用可變結構系統理論，設計一組強健型控制器，電腦模擬結果顯示其效果良好，這也證明了本文提出的全新鋰電池模型非常適合於現代控制理論之應用。

關鍵詞：鋰電池、磷酸鋰鐵(LiFePO₄)、電池建模、狀態空間、可變結構控制(VSC)

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