

Problem Chosen

Y

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MCM/ICM
Summary Sheet

Team Control Number

1234567

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Summary

This is abstract. This section should describe what problem the paper solves, what methods are applied, what results are obtained and summarize them.

This is the second line abstract. And if you look carefully you can see that the spacing within and between paragraphs is different, which facilitates our reading in paragraphs.

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Keywords: Fighting Wildfires; Multi-Objective Optimization; Poisson Distribution; Tabu Search Algorithm; Sensitivity Analysis

Contents

1 Ideal Battery

1.1 Assumptions

To consider an simplest ideal battery model, the following assumptions are made:

- The battery is kept at a constant environment, so the temperature effects are neglected.
- The battery has no energy loss during charging and discharging.
- The battery has infinite cycle life, so the degradation effects are neglected and all the parameters are constant.

1.2 Thevenin Model

A Li-ion battery system can be extremely complex, involving electrochemical, thermal and mechanical processes. However, for system-level studies, an equivalent circuit model is often used to represent the battery behavior. The Thevenin model is a widely used equivalent circuit model that captures the dynamic response of the battery voltage during charge and discharge cycles. The model is described as follows:

According to experimental experiences, the SoC is positively correlated with the open-circuit voltage U_{OC} , so we can express SoC as a function of U_{OC} :

$$SoC = f(U_{OC}) \quad (1)$$

in which $f(\cdot)$ can be obtained through curve fitting based on experimental data.

The relationship between U_{OC} and other parameters in the Thevenin model can be expressed with Kirchhoff's laws:

$$U_{OC} = U_t + IR_0 + U_1 \quad (2)$$

in which U_t is the terminal voltage.

For U_1 we have:

$$I = C_1 \frac{dU_1}{dt} + \frac{U_1}{R_1} \quad (3)$$

Differentiateing the SoC's definition with respect to time, we get:

$$\frac{d(SoC)}{dt} = -\frac{I}{Q_{max}} \quad (4)$$

where Q_{max} is the maximum capacity of the battery.

Combining the above equations, we can derive the complete Thevenin model in matrix form:

$$\frac{d}{dt} \begin{bmatrix} SoC \\ U_1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & -\frac{1}{R_1 C_1} \end{bmatrix} \begin{bmatrix} SoC \\ U_1 \end{bmatrix} + \begin{bmatrix} \frac{1}{Q_{max}} \\ \frac{1}{C_1} \end{bmatrix} I \quad (5)$$

1.3 Simulations

1.4 Result