# Lithium Ion Battery Failure Detection Using Temperature Difference Between Internal Point and Surface

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## Abstract:

Lithium-ion batteries are widely used for portable electronics due to high energy density, mature processing technology and reduced cost. However, their applications are somewhat limited by safety concerns. The lithium-ion battery users will take risks in burn or explosion which results from some internal components failure. So, a practical method is required urgently to find out the failures in early time. In this thesis, a new method based on temperature difference between internal point and surface (TDIS) of the battery is developed to detect the thermal failure especially the thermal runaway in early time. A lumped simple thermal model of a lithium-ion battery is developed based on TDIS. Heat transfer coefficients and heat capacity are determined from

simultaneous measurements of the surface temperature and the internal temperature in cyclic constant current charging/discharging test. A look-up table of heating power in lithium ion battery is developed based on the lumped model and cyclic charging/discharging experimental results in normal operating condition. A failure detector is also built based on TDIS and reference heating power curve from the look-up table to detect aberrant heating power and bad parameters in transfer function of the lumped model. The TDIS method and TDIS detector is validated to be effective in thermal runaway detection in a thermal runway experiment. In the validation of thermal runway test, the system can find the abnormal heat generation before thermal runaway happens by detecting both abnormal heating power generation and parameter change in transfer function of thermal model of lithium ion batteries. The result of validation is compatible with the expectation of detector design. A simple and applicable detector is developed for lithium ion battery catastrophic failure detection.

## Description:

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