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A Data Driven Approach for the Degradation of a Lithium-Ion Battery Based on Accelerated Life Test

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Abstract : Lithium ion batteries are currently used for many applications including satellites, electric vehicles and mobile electronics. Their ability to store relatively large amount of energy in a limited space make them most appropriate for critical applications. Evaluation of the life of these batteries and their reliability becomes crucial to the systems they support. Reliability of Li-Ion batteries has been mainly considered based on its lifetime. However, another important factor that can be considered critical in many applications such as in electric vehicles is the cycle duration. The present work presents the results of an experimental investigation on the degradation behavior of a Laptop Li-ion battery (type TKV2V) and the effect of applied load on the battery cycle time. The reliability was evaluated using an accelerated life test. Least squares linear regression with median rank estimation was used to estimate the Weibull distribution parameters needed for the reliability functions estimation. The probability density function, failure rate and reliability function under each of the applied loads were evaluated and compared. An inverse power model is introduced that can predict cycle time at any stress level given.

Keywords : accelerated life test, inverse power law, lithium-ion battery, reliability evaluation, Weibull distribution
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