Prognostication of Flexible Batteries in Wearable Electronics

Lall, Rahul

Wearable electronics are finding new applications in everyday life. Future adoption of wearable electronics into applications such as medical diagnostics, identity protection, and asset situational awareness requires the development of form factors which are seamlessly integrated into wearable garments and on the surface of skin. Flexible wearable electronics are subjected to a greater deal of mechanical and environmental stresses while attempting to maintain functionality. Wearable applications need thin and flexible form factors for the energy storage to drive sensing, displays, control, and processing. Energy storage of these wearable applications most likely requires the ability to sustain use and recharge cycles. In this paper, the state of art flexible battery technologies commercially available have been studied for their survivability under exposure to environmental loads typical of wearable electronics applications (bending). The charging and discharging cycles were performed on the flexible battery with a custom designed test station. The test station included a linear actuator setup (programmable electronic load), microprocessor, and a data logger. All hardware was controlled using LabVIEW. Additionally, a method for prognosticating the capacity degradation and remaining useful life has been developed using Extended Kalman Filtering (EKF). It is expected that the developed system will expedite the use of flexible electronics and broaden their applications.

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