Physics Guided Reliability Model Development

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Abstract

There are two main components in the development of a degradation model: (1) finding a health index that is indicative of the degradation behavior, and (2) finding a model that describe degradation behavior. In this discussion, we shall demonstrate how domain knowledge can be useful in both of these tasks. In the first example, monitoring of lithium battery degradation, the health index, capacity loss, of the battery is well defined. However, the degradation process is complex. We shall show how a hybrid model using I-spline and electrochemical theory is able to fit data of early degradation and predict onset of rapid degradation. On the otherhand, in many chemical processes, degradation of catalyst activity cannot be measured directly. Coefficients in physical models can be estimated using plant data with complex physic model as an observer.

Keywords：Physics Guided, Reliability Model