Usage of Accelerated Test Data for Predicting Remaining Useful Life at Field Operating Conditions

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ABSTRACT

Prognostics predicts future damage/degradation and the remaining useful life of in-service systems based on damage data obtained during previous usage. General prognostics methods are physic-based approaches when physical models and loading conditions are available and data-driven approaches when only the damage data are available. The damage data are of great importance regardless of prognostics methods used, but it is very expensive to obtain data from in-service systems because of time and cost. Instead, companies frequently perform accelerated tests under much more severe operating conditions for the purpose of design. This paper presents a method of utilizing accelerated degradation data for the purpose of prognostics. As an example, crack growth data are synthetically generated under over-loaded conditions, which are utilized to predict damage growth and remaining useful life at field operating conditions. Four different scenarios are considered based on the availability of a physical model and field loading conditions. Using accelerated test data increases prediction accuracy in the early stages of physics-based prognostics and also compensates for the insufficient data problem in data-driven prognostics.