

Warranty Prediction Based on Auxiliary Use-rate Information

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Abstract

Usually the warranty data response used to make predictions of future failures is the number of weeks (or another unit of real time) in service. Use-rate information usually is not available (automobile warranty data are an exception, where both weeks in service and number of miles driven are available for units returned for warranty repair). With new technology, however, sensors and smart chips are being installed in many modern products ranging from computers and printers to automobiles and aircraft engines. Thus the coming generations of field data for many products will provide information on how the product has been used and the environment in which it was used. This paper was motivated by the need to predict warranty returns for a product with multiple failure modes. For this product, cycles-to-failure/use-rate information was available for those units that were connected to the network. We show how to use a cycles-to-failure model to compute predictions and prediction intervals for the number of warranty returns. We also present prediction methods for units not connected to the network. In order to provide insight into the reasons that use-rate models provide better predictions, we also present a comparison of asymptotic variances comparing the cycles-to-failure and time-to-failure models.