Integrated Maintenance Optimization and Degradation Parameter Learning

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The main purpose of this project is to bridge a gap between existing reliability literature and maintenance optimization literature for advanced capital goods. We consider the common situation of a component displaying certain degradation over time. By Condition Monitoring (CM), remaining useful life or future degradation processes can be predicted through stochastic degradation modelling. Stochastic degradation models considering temporal variability and unit-to-unit variability have been proposed in the literature of the reliability engineering field. However, in the maintenance optimization literature, models are not sufficient or accurate in considering these variances that stem from the heterogeneity of the population of units or from non-measurable external effects. We propose maintenance optimization models that adaptively schedule inspections and replacements based on the stochastic degradation models taking unit-to-unit variability into account. Beliefs about unitspecific parameters are updated upon inspections by using a Bayesian technique (degradation parameter learning). We aim to consider: (1) adaptive scheduling of inspections and replacements for a stochastic process model in absence of unit-to-unit variability; (2) adaptive scheduling of inspections and replacements for a stochastic process model with unit-to-unit variability; (3) adaptive scheduling of inspections and replacements with unknown unit-to-unit variability.