Exploring the Power of Markov Models for Comprehensive Prognostics

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ABSTRACT

Prognostics involves the prediction of the remaining useful life or other essential properties of an engineering system. By utilizing prognostics, predictive maintenance can optimize availability, reliability, and adherence to safety standards during operation. However, implementing prognostics in engineering systems presents challenges, including the stochastic nature of prognostics due to inherent sources of uncertainty. Additionally, complexities arise from dealing with limited data and the necessity for specific characteristics to facilitate decision-making. To overcome these challenges, numerous prognostic approaches have been proposed in literature. In this seminar session, we will delve into how Markov models can significantly enhance prognostic reliability, robustness, and applicability. We will explore various types of Markov models, including Hidden Markov Models (HMMs), Hidden Semi-Markov Models (HSMMs), Non-Homogeneous Hidden Semi-Markov Models (NHHSMMs), and their adaptive versions. Furthermore, we will apply these models to aerospace case studies to demonstrate their effectiveness and practical utility.