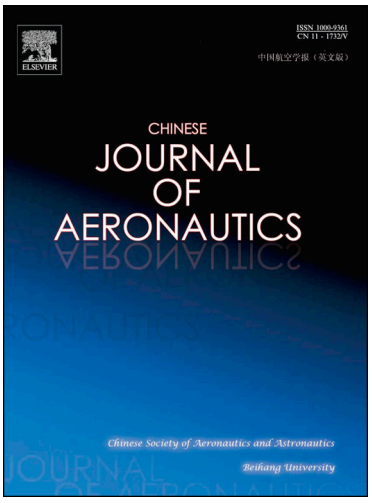

Full Length Article

A Bayesian approach for integrating multilevel priors and data for aerospace system reliability assessment

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A Bayesian approach for integrating multilevel priors and data for aerospace system reliability assessment

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Abstract

This paper investigates Bayesian methods for aerospace system reliability analysis using various sources of test data and expert knowledge at both subsystem and system levels. Four scenarios based on available information for the priors and test data of a system and/or subsystems are studied using specific Bayesian inference techniques. This paper proposes the Bayesian melding method for integrating subsystem-level priors with system-level priors for both system- and subsystem-level reliability analysis. System and subsystem reliability outcomes are compared under different scenarios. Computational challenges for posterior inferences using the sophisticated Bayesian melding method are addressed using Markov Chain Monte Carlo (MCMC) and adaptive Sampling Importance Re-sampling (SIR) methods. A case study with simulation results illustrates the applications of the proposed methods and provides insights for aerospace system reliability analysis using available multilevel information.

Keywords: System reliability; Bayesian inference; Bayesian melding; Multilevel information; Markov Chain Monte Carlo (MCMC); Sampling Importance Re-sampling (SIR)

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