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PREDICTIVE MAINTENANCE FOR FLIGHT SAFETY COMPONENTS PRONE TO SEVERE UNCERTAINTY THROUGH REANALYZING THE CHALLENGER DISASTER: AN INFO-GAP THEORY IMPLEMENTATION

Abstract

Many efforts are invested in predictive maintenance. Well designed failure prediction can greatly save time, reduce costs, and in many cases, may be the difference between life and death. Many complicated systems, such as flight platforms, are characterized by severe uncertainty, with which the failure prediction is supposed to deal. In this work, we will reconstruct a failure prediction and suggest new methods for constructing such predictions, based on info-gap theory. The core of this work is the development of a variety of info-gap methods dealing with non-probabilistic uncertainty governing procedures of system failure predictions. The discussed example in this work is the prediction of launch failure of the Challenger spacecraft, based on data preceding the disaster. A failure prediction was reconstructed using logistic regression over that data. In addition, Info-Gap models were developed in order to deal with the severe uncertainty tied to that data. Different robustness functions were developed for each Info-Gap model, which were also robust against either false alarm or missed detection, depending on robustness definition. Moreover, non-logistic estimations were suggested and tested. An example of a comparison method between meanings of different Info-Gap models was also given.