Detecting and Predicting Anomalies in Satellite Systems

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ABSTRACT

Satellite systems are designed to be reliable and failures or anomalies do not often occur. However, if they do occur they can have critical consequences and an enormous economic impact. Data-driven prognostics and anomaly detection approaches, which aim at predicting the occurrence of anomalies using operational and environmental data, have the potential to anticipate such events in advance. Satellite system behaviour and health is continuously monitored and collected. The underlying telemetry data linked to anomaly reports or alerts can form a baseline for anomaly detection techniques. Previous studies on this topic have been performed and show promising results. In our study, we aim at developing those further in two ways: First, instead of merely detecting anomalies we make use of prognostic techniques to predict the occurrence of anomalies. Second, we link such techniques to uncertainty measures and quantify the uncertainty of the predictions. In a case study we apply the anomaly detection technique to Reaction Wheel data. The first results show the potential of such a prognostic model to predict anomalies. This, in further consequence, can help to improve satellite reliability estimation and better assess risks for satellite mission extension.

Preferred Session: Autonomy and reliability of small satellites for deep-space exploration