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Space Debris Detection, Tracking and Characterization - SST (1)

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RESEARCH AND PERFORMANCE ANALYSIS OF THE SPANISH SURVEILLANCE RADAR

Abstract

The Spanish Space Surveillance and Tracking Surveillance Radar (S3TSR) is a radar system developed by Indra within a project technically followed by ESA and funded by the Spanish Administration through CDTI management. It is a ground-based radar in close monostatic configuration, operating at L-band and is able to maintain a large catalogue of objects in the low-Earth Orbit region crucial for preventing further debris generation and providing services such as collision avoidance.

The system measures the range, range-rate, and line-of-sight of debris and other objects, but also derives a radar-cross-section (RCS) estimate from the signal-to-noise ratio. While RCS values are highly variable and difficult to predict due to the complex signal reflection process, the distribution per target can be often well approximated. In order to identify the potential of measured RCS distributions, a simple target is modeled and its RCS simulated using electromagnetic numerical codes. Additionally, it is assessed how measured RCS values can support an attitude determination process. The results from both investigations highlight the complexity of RCS signals and open up further research opportunities in this domain.

After more than two years in operation, an overview of the performances and the S3TSR contribution to safeguard the space environment will also be presented, assessing the powerful potential the S3TSR

has with its scalability design. The performance of the system is demonstrated by analyzing the collected operational surveillance data. The measurement accuracy is assessed using reference objects with well-known orbits e.g. provided by the ILRS. Additionally, the detection performance is monitored by statistically predicting detection number probabilities and comparing the predicted ones with measured values.