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Title

From Visual Inspections to AI-Driven Checks: Automating Quadrant Star Sensor Calibration Space Operations

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Abstract

We present a new application for automating Quadrant Star Sensor (QSS) calibration space operations, which has the potential to revolutionize the way in which we calibrate and maintain satellites in orbit. Calibration of the QSS is essential for accurate satellite pointing and navigation, which are critical for achieving the mission objectives of the spacecraft. However, performing these operations is time-consuming, requiring significant human intervention and expertise, and is therefore a costly and resource-intensive process.

Our application automates most of the checks involved in QSS calibration, freeing up operators' time to focus on more complex tasks. The automation of these tasks means that we can process several QSS checks simultaneously, which is a significant advantage, especially when dealing with a large fleet of satellites. In addition, the use of automation means that we can perform these checks around the clock, ensuring that the calibration of the QSS is always up-to-date.

One of the challenges we faced in developing this application was to find a way to automate a visual check that was traditionally performed by an operator. This check involved visually inspecting the calibration pattern to ensure that the QSS was calibrated correctly. We developed an Artificial intelligence (AI) model that could perform this check, replacing the need for an operator to perform the task. This AI model has been found to be more accurate than human operators in detecting invalid QSS, which were not visible to the naked eye.

The application we developed has undergone extensive testing, and the results have been very positive. The use of automation has significantly reduced the time required to perform these operations, enabling us to process more checks in less time. Furthermore, the use of an AI model has increased the accuracy of the checks, reducing the risk of errors in calibration. This increased accuracy is especially important for missions where accurate pointing and navigation are essential, such as Earth observation or communication satellites.

In conclusion, the application we have developed for automating QSS calibration space operations has the potential to transform the way in which we calibrate and maintain satellites in orbit. The use of automation and AI models increases the accuracy of the checks, reduces the risk of errors, and frees up valuable operator time. We believe that this application will have significant benefits for the space industry, making it easier, faster, and more cost-effective to maintain and calibrate a large fleet of satellites.