Just Passing Through: Use of Hemispheric Sensing with Trajectory Prediction for Satellites to Mechanically Dodge Small Space Debris

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Space debris of any size can cause irreparable damage to multimillion-dollar satellites. Satellites typically dodge space debris via an orbital maneuver drawing from their finite fuel supply, but this option can negatively affect length of the mission. However, new satellite systems could be divided into multiple subsections to perform mechanical orbital maneuvers and avoid space debris without propellant loss. This approach requires an onboard detection system with multiple sensors and corresponding algorithms capable of predicting the trajectory of localized space debris. In the best-case scenario, the satellite would be segmented, with its sections mechanically separated, allowing the detected space debris to pass through the more vacant center of mass. Afterwards, the total module would be reintegrated. To model the sequence described, multiple prototypes were designed, built, and tested. Majority of the prototypes were tested for separation distance, frequency of successful detection, and completeness in reintegration cycles, especially after basic functionality was achieved. While the latest prototype was the most promising, it still required scaling up to a version that is capable of wider separation of parts to permit debris of several kilometers to pass through the system.

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