Orbit determination by merging optical, radar and laser measurements

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The proliferation of space debris puts the continuity of space missions at risk and poses a serious challenge to be corrected. The number of objects classified as space debris is increasing rapidly, especially in regions of high interest for commercial or scientific exploitation (LEO and GEO). Due to the high added value of these regions, the cataloging, and more specifically, the orbit determination of space debris objects has become a topic of great importance and growing interest.

This study outlines the Initial Research Plan of the doctorate entitled "Orbit determination of space debris objects from the fusion of the information obtained by different sensors", included in the Aerospace Engineering Doctorate Program of the Carlos III University of Madrid. The main objective of this study is to analyze the benefits of merging laser distances, radar observations and angular measurements in the same orbit determination process.

During the development of the thesis, access to data from different sensors will be available for scientific exploitation: a) laser measurements from stations belonging to ILRS, b) angular measurements from the TFRM telescope and c) observations from the S3TSR radar. With the use of these real measurements, it is intended to show how the observed object-sensor geometry affects the results, as well as the precision of the sensors used, the number of observations and the observed arc length, among other factors. Likewise, it is intended to investigate the different algorithms and mathematical methods that lead to orbital determination and to explore techniques that allow real-time corrections to be applied to the analyzed orbits.