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IMPROVED ACCURACY IN THE PREDICTION OF CONJUNCTION EVENTS: CASE OF COLLISION BETWEEN IRIDIUM 33 AND COSMOS 2251

Abstract

After the collision event occurred between the Iridium 33 satellite and the 16-year-old Russian Cosmos 225, a number of analysis are executed in order to assess whether this event could be predicted, and thus avoided.

The analysis presented in this paper is related to the assessment of the prediction capability by means of propagation based on TLE theory. This capability is compared with that obtained by means of precise propagation. As the unique source of information for the orbital data of orbiting objects currently comes from TLE data, it is required to obtain the most precise state vectors from this catalogue before entering in a precise propagator. The process of obtaining such a precise state vector is based on the fitting of the TLE data within a time interval. Performances of such fitting process are presented for the two objects involved in the event.

The analysis here presented is based on historic TLE data of both objects. The conjunction search based on pure TLE data and TLE theory provides the capability of raising a warning, which is not systematically maintained during the days before the event. On the contrary, the collision prediction based on the most precise propagation of state vectors provides a better prediction of the event, with smaller estimated miss-distances and larger collision probabilities. This second method would allow raising a more confident warning, although its capability is also limited due to the accuracy of the objects state vectors.

A collision with similar features than the Iridium-Cosmos event is also simulated with the AS4 tool. This tool is a simulator of the performances of a Space Situational Awareness System (SSAS). The simulated event allows assessing the prediction capability for the case of having precise orbital information coming from a Surveillance system as the one proposed for the future European SSAS. The advantage of this approach is the existence of precise orbital data for the orbiting objects with accurate knowledge information (in terms of covariance matrix). Moreover, it is supposed that the orbital data is used as it is contained in the catalogue, so that, accuracy is not degrade due to the use of an ephemeris format (as the case of TLE data).