A New Method to Compute the Probability of Collision for Short-term Space Encounters

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The increasing number of space debris in Low Earth Orbits constitute a serious hazard for operational satellites. In order to provide adequate collision avoidance strategies, it is important to determine the collision probability between two orbiting objects. Three-dimensional Gaussian probability densities represent the position uncertainties of the objects. With some simplifying assumptions, the problem of computing the collision probability, for short-term encounters between space-borne objects, is, in practice, reduced to a two-dimensional integral of a Gaussian function over a bounded region in a plane normal to the relative velocity vector (encounter frame). The method presented here is based on an analytical expression for the integral. It has the form of a convergent power series whose coefficients verify a linear recurrence. It is derived using Laplace transform and properties of D-finite functions. We focus on its efficient and reliable numerical evaluation. This talk is based on [1].

References

[1] R. SERRA, D. ARZELIER, **M. JOLDES**, J.-B. LASSERRE, A. RONDEPIERRE AND B. SALVY, *A New Method to Compute the Probability of Collision for Short-term Space Encounters*, AIAA/AAS astrodynamics specialist conference, American Institute of Aeronautics and Astronautics, pages 1-7, 2014.