A NEW FAST CLOUD PROPAGATOR FOR USE IN THE GEO REGIME

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As the space debris population continues to increase, there is a growing need to develop models that can quickly and reliably characterise the future debris population. A number of fast debris propagators exist, which claim to be able to model the future environment to a high degree of accuracy. However, these propagators have limitations that only allow them to be used for certain debris size ranges or within certain altitude ranges, i.e. mostly low-Earth orbit (LEO) regions. To date, little work has been done in developing a debris propagator that can be used to quickly propagate debris in the geostationary (GEO) regime. The ability to develop a model capable of quickly and accurately characterising the long-term evolution of debris in the GEO regime is becoming ever more important as the GEO debris population continues to increase.

A new, GEO-dedicated, fast debris cloud propagator is proposed, which will propagate the debris cloud as a whole, rather than as the summation of a number of fragments or pseudo-fragments. The fast cloud propagator (FCP) first identifies the number and mass distributions of the debris fragments in six-dimensional element-space and also identifies the distributions of the element relationships with one another, for example, the distribution of fragments in an eccentricity vs. inclination scatter plot. The means and 3-sigma values of these distributions are then propagated to the required epoch and the element number and mass distributions are re-created using the propagated mean and 3-sigma values. The new element relationships can also be recovered using the propagated distribution parameters and the debris cloud can thus be accurately re-created. This method gains a large speed increase over conventional propagators by only propagating the distribution parameters, a total of 25 objects, rather than individually propagating the large number of fragments found in the original debris cloud, as is usual practise.