

# **A new safety probability method of judging collision between shuttle and debris**

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Space debris collision is threatening space missions. The collision probability model is an effective method of short-term collision(<3days) forecast, but not of long-term(>3days). As the size of shuttle is fixed, the collision probability is subject to the probability density function. The collision probability forecast is usually more credible in short-term than in long-term. It is necessary to find a new method based on statistics and probability theory, which is effective to long-term collision probability forecast.

Based on the distribution function of multidimensional random variable and the distribution of random variable function, the formula of probability distribution and probability density of the total error of orbit prediction is developed in this paper. By the analysis, the ECPD (equipotential conicoid of probability density) is put forward to describe the total error of orbit prediction and an error model of orbit prediction and a safety probability model are established. The safety probability model will be used to analysis of typical case of the collisions between debris. The results of this analysis will be presented and discussed. Finally, potential improvements to this method will be presented.