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STATE EVOLUTION OF SPACE OBJECTS

Abstract

Orbital uncertainty propagation is very important in space situation awareness. The nonlinear semi-analytic filter based on the state transition tensors method can perform sequential estimation of the state of space objects. However, this method needs to manually derive the dynamic model, which is not conducive to extending to complex nonlinear dynamic systems. In order to solve this problem, differential algebra method can automatically carry out Taylor polynomial expansion for nonlinear functions, and more forms of polynomial expansion have been developed. However, the computational efficiency of this method decreases rapidly with the increase of the order and the number of variables. The main reason for the reduction of the computational efficiency is that the number of multiplication and division operations required by the program in the automatic expansion of polynomials increases significantly. In order to further reduce the computational time, this paper uses the idea of interpolation to automatically expand polynomials, instead of the program rules of the automatic expansion of differential algebra method. At the same time, a numerical integration solver is designed, and numerical experiments are carried out on the accuracy and calculation time. Based on this method, a nonlinear semi-analytic filter is designed to estimate the state of space objects.