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LANDING POINT PREDICTION OF MANNED SPACECRAFT BASED ON FINE MODEL OF RECOVERY AND LANDING SYSTEM

Abstract

Reentry of parachute-vehicle system is the last step of manned space flight, and it also marks the success or failure of task. Experiments show that reentry trajectory of parachute-vehicle system is affected by horizontal wind. If there was strong horizontal wind, landing point of parachute-vehicle system would drift very far, which would extend collection scope and increase collection time. At present, based on 3 DOF dynamics model, together with wind field data of landing zone, landing point of manned spacecraft SHENZHOU is predicted by integral and the error of which is up to 10km.

In this paper, with consider of the effect of gravity and gravitational moment, aerodynamic force and moment, constraint force and moment of parachute cord on parachute-vehicle system, a 12 DOF multi-body dynamics model of parachute-vehicle system was founded, based on which a prediction strategy of reentry trajectory was proposed., which can be used to deal SZ-8 reentry trajectory problem. With the experiment data of SZ-8, precision of the fine multi-body dynamics model was verified and compared with 3-DOF dynamics model.

Experiments show that reentry trajectory predicted based on the fine multi-body dynamics model is consistent with the true trajectory and landing point prediction error less than 1.5km with initial height 10km. With the descent of initial height, prediction accuracy is improved gradually. Compared with 3-DOF dynamics model, the effect of wind is well dealt, efficiency and the precision of landing point prediction is enhanced greatly, so with this research, the succor scope and collection time are reduced.

Key Words: Manned Spacecraft, Trajectory of Parachute-Vehicle System, Landing Point Prediction, Recovery and Landing