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THE EFFECT OF CONTROL POWER FOR SPACECRAFT HANDLING QUALITIES

Abstract

Spacecraft handling qualities is the qualities of pilot in the loop's motion control task, decides whether astronaut can safely successfully and efficiently complete each designated mission., on the other words, it stands for the characteristics of people-machine system. Based on that, it is affected by many factors; including environment, control mode, pilot skill, display mode, controller characteristics and reaction control power and so on. Among these factors, equivalent control power will obviously affect spacecraft's dynamic behavior after spacecraft's structure is fixed. Considers pilot's intellection, prediction and control tactic ,this paper advances a forecast-fuzzy control pilot model, this model adds an forecast segment which is differ from normal fuzzy control model. That is because there exists time delay in spacecraft control loop, the forecast segment reflects people's prediction, then the fuzzy model reflects people's intellection and control tactic. The pilot-in-the-loop simulation results showed that significantly different spacecraft handling qualities result from the design of the equivalent control power. On the other hand, in order to give suggestion to manual control system design, it is necessary to compute the most appropriate control power. Genetic algorithm is an intelligent optimization algorithm, it has global searching ability and it is fit for solving nonlinearity problems. The pilot-in-the-loop control is a strong nonlinearity problem, so it is better to makes use of genetic algorithm method to optimize control power design. Among motion control task, control stability, celerity and propulsion consume is the most concerned target, this paper takes ITAE (Integral Time Absolute Error) and propulsion consume as estimate goal, and gives the most appropriate control power based on parameters of existing spacecraft .