

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
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## APPLICATION OF GREY SYSTEM THEORY IN MODELING PSEUDO-RANGE MEASUREMENTS

**Abstract**

Grey system theory, which works on unascertained systems with partially known and partially unknown information by drawing out valuable information and also by generating the partially known information, has been successfully applied to various fields and has made a success in analyzing uncertain systems that have discrete and insufficient data. Grey predicting, which uses comprehensive mathematics method to predict the incomplete system of information, is an important composition of grey system. In contrast to traditional prediction models, the main attributes of grey prediction model, are that it does not need to make strict assumptions about the data set and it is used successfully to analyze uncertain systems that have discrete and insufficient data. In addition, it can accurately depict and distill the inner change direction of original data sequence, and achieve a comparatively high precision to the future mode prediction of the system. Therefore, the grey system theory is introduced into the field of GPS navigation, so as to solve the problem of the pseudo-range measurements prediction. Simulation and modeling of pseudo-range measurements have drawn tremendous attention in GPS navigation, and some prediction models have been proposed. These models can be used for GPS system analysis, error's mitigation, and so on. Unfortunately, these models are mainly based on the mathematical statistics, and contain some limitations. When the assumptions of models are different from the actual situations, the simulated result of residuals from these methods was not satisfied with the needs of special application. Aiming at the applicability problem and prediction precision for the traditional models, this paper presented a novel pseudo-range measurements prediction model using grey system theory. The method changes the traditional modeling thought, and brakes away from the statistical distribution assumption about the data set in the modeling process. It has better applicability, which improves the incongruence of model application to some extent. Finally, experimental results show that the proposed model can reproduce the pseudo-range measurements with residues less than 2 meters, and also indicate that grey system theory is a good approach to providing a more accurate prediction of pseudo-range measurements than previous methods. The research work in this paper paves the way for pseudo-range measurements modeling, and should be valuable in the project application and the theory research of GPS system analysis and error's mitigation.