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Author: Mr. Pan HUANG
Nanjing University of Aeronautics and Astronautics, China, nuaahuangpan@163.com

Prof.Dr. qiuming zhu
Nanjing University of Aeronautics and Astronautics, China, zhuqiuming@nuaa.edu.cn
Prof. chenghua wang
Nanjing University of Aeronautics and Astronautics, China, chwang@nuaa.edu.cn
Mr. Baobi XU
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, xubaobi@163.com
Mr. Yu HAN
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology (CAST), China, hanyuBISSE@163.com
Dr. Xueqiang Chen
Nanjing University of Aeronautics and Astronautics, China, yuwencxq123@126.com

AN MODIFIED PROPAGATION LOSS PREDICTION METHOD OVER LUNAR SURFACE

Abstract

Most of the traditional radio models are invalid due to the special propagation environment on lunar. A modified path loss prediction method over lunar surface is proposed in this paper, which taking in account the extra influence from the isolated obstacles on the theoretical segment prediction model. The theoretical segment model can be divided into three scenarios, free space zone, two-ray zone and spherical diffraction zone, according to the different communication distance. The propagation loss is given by $L_F = 32.44 + 20log(f/10^6) + 20log(d/10^3)$ in the free space zone, while the path loss of reflection zone and diffraction zone can be derived by adding an extra loss caused by reflection path or diffraction path on lunar surface to L_F. In addition, the isolated obstacles along transmission path are proved not only causing an additional loss but also affecting distance-threshold of the theoretical segment model. This paper summed up the isolated obstacles as three scenarios including single obstacle, double isolated obstacles and multiple isolated obstacles. The diffraction loss of single obstacle is given in Recommendation ITU-R P.526-9, while for double isolated obstacles the loss can be calculated by two simplified solutions, alternative or master- slave procedures. The diffraction loss of multiple isolated obstacles can be obtained by picking out a main obstacle and two vice-obstacles on both sides of the main one and then employing the simplified method in double obstacles model twice. It should be emphasized that the zone segmentation of theoretical segment model should be modified for some cases. For example, when the obstacle located at or before the reflection zone, the reflection signal path will be cut off by it, so the reflection loss is ignored behind the obstacle. Finally, our method is applied to the simulation scenes given by National Aeronautics and Space Administration (NASA), the prediction results are very close to the actual measurement data over lunar surface from Apollo project. So, this method will be very helpful for system design and performance evaluation of lunar communication system.