SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Mobile Satellite Communications and Navigation Technology (4)

Author: Dr. Tong Yang
China Academy of Space Technology (CAST), China, yantcast@163.com

Mr. Jun Niu
China Academy of Space Technology (CAST), China, nj@yahoo.com
Dr. Ming-feng Li
China Academy of Space Technology (CAST), China, lmf@yahoo.com
Prof. Feng-chun Wang
China Academy of Space Technology (CAST), China, wfc@yahoo.com

AN IMPROVED GENETIC ALGORITHM BASED LINK OPTIMIZATION FOR TDRS

Abstract

The Tracking and Data Relay Satellite(TDRS) is normally considered as a relay station between Ground Station(GS) and spacecraft, which is launched at GEO orbit. Since the TDRS can provide various kinds of data transmitting links, it possesses the capability to supply multi-services to various spacecrafts on different LEO or MEO orbits.

Commonly, different links usually require dissimilar transmitting performances; it is need to dynamically configure the EIRP, G/T and Bit Rate parameter according to the relative link performance requirement. However, the total link transmitting capability is always limited and restricted at a certain level; we would like to optimize every link performance to satisfy its service as much as possible. Therefore, this paper proposes a novel approach adopting an improved Genetic Algorithm, to optimize every link performance in the TDRS system.

Genetic Algorithm is based on the principle of "Survival of the Fittest". Above all, a group of target parameters would be initialized to each link, afterwards, by means of evaluating the channel transmission parameters requirement of each data link to various spacecraft, the target parameters such as EIRP. G/T and Bit Rate are able to be assigned to proper user spacecraft links to content with their requirement by raising several iterative operations of crossover and mutation. Moreover, considering the long time delay and complex devices in satellite system, this Genetic Algorithm is being improved to be with a lower computational complexity, which would be easier to future engineering realization.

Finally, this paper presents the detailed approach of this new method, and enumerates some examples to test and prove it. Through the validation of numerical simulation, it is shown that the novel method is generally superior to the traditional "Decision Matrix" method considering computational complexity, mean iterative frequency, as well as average failure rate(reliability) performances. As all target parameters are dynamically distributed to proper user spacecraft links, the EIRP, G/T, as well as the Bit Rate performance of each link can be equalized with each other, and the whole link resources are well optimized. Meanwhile, it also advances the system transmitting BER performance within certain links.