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GENETIC ALGORITHM-BASED CONSTELLATION ORBIT DESIGN FOR EFFICIENT INTEGRATED OPERATION OF SINGLE SATELLITES AND INCREASE OF THE TEMPORAL RESOLUTION OF SATELLITE INFORMATION

Abstract

The biggest advantage of fusing satellite information obtained from multiple satellites is that satellite information can be acquired in a timely manner. While each single satellites in operation can image a specific area once or twice a day, if each satellite is operated as one constellation, the frequency of imaging for a specific area can be increased several times or more. Satellite information with various temporal-spatial resolutions obtained from various sensors can be used image fusion in various fields such as disaster monitoring including forest fires, droughts and etc., as well as reconnaissance and resource exploration. But each single satellite developed individually has optimized orbits according to the sensor characteristics, the integrated operation of each satellite as it should have a low temporal resolution. In this paper, a method for designing a constellation orbit using a genetic algorithm is introduced in order to ensure that various satellite information acquired through integrated operation of existing single satellites and single satellites to be launched in the future can have high temporal resolution. Only the RAAN of the satellite to be launched in the future was considered to optimize the revisit characteristics for a specific area in order to minimize the effect on the sensors of each satellite and the change of the orbit of the already operating satellites. The fitness functions of genetic algorithm were applied differently for the optical and SAR satellite since the available imaging time is different. In case of optical satellites, considering that imaging is possible only during day time, the fitness function was set so that the available imaging time for a specific area could be concentrated during the day time. Since the SAR satellites do not have any restrictions on the available imaging time, the fitness function was set to so that the revisit time is evenly distributed. The result show that the revisit characteristics for a specific area increased; the number of access for a specific area during day time increased for optical satellites and the maximum revisit time decreased for SAR satellites compared to using the existing orbit. The genetic algorithm-based constellation orbit design method presented in this paper effectively integrates the existing single satellites and the single satellites to be launched in the future to obtain satellite information with high temporal resolution, thereby increasing the efficiency of satellite information fusion and application.