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MONITORING AND ASSESSMENT OF CLIMATE CHANGE USING AN OPTIMAL RECONFIGURABLE FLOWER CONSTELLATION

Abstract

Human ambition in the modern age for industrial developments led to unfavorable changes in the climate balance, and as a result, natural disasters have caused irreparable damage to our blue planet. The time-variable observation, understanding, assessment, and prediction of the consequences of climate change is an essential requirement for the survival of globe life. One of the crucial issues in such daunting disasters is monitoring fast recognition and global coverage of the Earth for interrelated urgent efforts. In this regard, the use of space technologies creates a hybrid constellation of satellites with remote sensing and communication payloads due to their ability to fast and global data collection can be a powerful solution for simultaneously addressing climate change and advancing development. This paper aims to present an optimal approach to design a flower constellation (FC) to provide global coverage. In this mission, the main goal of remote sensing is to global coverage to observe the mass changes of polar glaciers and ice sheets, and changes in average global temperature in a long-term monitoring mission to allow assessment and forecast of a number of important climate trends, and improvements in agile service applications. In addition, the ability of the store-and-forward communication of the constellation is employed for collecting data on the level of greenhouse gas (GHG) emissions from the existing ground stations in countries. In order to avoid designing an expensive constellation with high number of satellites, this paper addressed an optimal design to minimize the number of satellites in a reconfigurable system which may also need to change to accomplish the mission. In this regard, to minimize the total v for the reconfiguration while simultaneously minimizing the number of satellites, the multi-objective evolutionary algorithm (NSGA-II) is utilized to find optimal FC designs. Examining the proposed method through a simulation reveals admissible accuracy for covering the desired area as well as collecting data by an FC which can be reconfigured whenever there is an environmentally urgent situation. Eventually, the feasibility of the proposed approach is demonstrated through corresponding simulations.