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RESOURCE ALLOCATION IN NGSO SATELLITE CONSTELLATION NETWORK CONSTRAINED BY INTERFERENCE PROTECTION TO GEO SATELLITE NETWORK

Abstract

In recent years, the increasing space data traffic demand gives rise to the rapid development of non-geostationary orbit (NGSO) satellite constellation networks, providing global satellite internet service. Also, spectrum sharing has been widely used due to the scarcity of spectrum resources, which may lead to co-frequency interference, especially from NGSO constellations to the geostationary orbit (GEO) satellites networks. Thus, the interference protection of GEO networks from NGSO networks has become a hot issue in the field of NGSO constellation, in accordance with the relevant rules of the International Telecommunication Union (ITU). Meanwhile, the emerging antenna technique, *electronically scanned phased array*, which is steerable, is gradually utilized in satellite communications lately. For NGSO satellite operators, how to upgrade the quality of NGSO communication service on the premise of avoiding harmful interference to GEO networks is the main challenge. In this paper, it is addressed by optimizing resources allocation (including satellite beams assignment and transmit power control) of NGSO satellite constellation network. We establish a system model of the spectral coexistence scenario between a NGSO satellite constellation network and a GEO satellite network in the downlink case. In this scenario, the NGSO network consists of multiple satellites, phased array steerable beams and earth stations (ESs). On basis of this, a NGSO system capacity optimizing problem is formulated with the GEO interference protection criteria, NGSO beam-ES scheduling constraints and transmit power constraints. This mixed integer non-convex problem is transformed into a convex one by relaxing its integer variables, and then resolved by means of Lagrangian dual decomposition method combined with the Kuhn-Munkres algorithm. Furthermore, numerical results based on a NGSO satellite constellation network and a typical GEO network, demonstrate the feasibility and effectiveness of our proposed method. We also consider two traditional methods based on the spatial isolation technique for comparison. All these three methods can avoid the harmful interference from the NGSO satellite constellation network to the GEO network successfully. Nevertheless, the proposed method outperforms other two methods by up to 18.9% and 14.7% relatively, in aspect of NGSO system capacity improvement. In summary, this resources allocation optimization scheme can be applied in all types of NGSO networks, which contributes to the development of the space information network.