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A PRIORITY-BASED RATELESS CODED COOPERATION COMMUNICATION SCHEME FOR SPACECRAFTS MULTI-ACCESS CHANNELS

Abstract

In this paper, a priority-based rateless coded cooperation wireless communication scheme (RCC-P) is proposed for spacecrafts multi-access channels. In the spacecrafts multi-access channels, there is one big spacecraft with several small spacecrafts flying around it. All the small spacecrafts transmit their own data to the big spacecrafts, which is as a common destination. The broadcast characteristic of wireless communication enables the small spacecrafts to overhear other small spacecrafts' transmission. In the proposed RCC-P scheme, each small spacecrafts does rateless coded cooperation and then forwards the resulting rateless coded symbols to the big spacecrafts. The reason that the rateless codes is adopted for the coded cooperation is that rateless codes are adaptively to the channel capacity, and have a low encoding complexity. Different from the existing rateless code cooperation methods in multi-access channels, in the propose RCC-P scheme there are no decoding operations in the cooperation stage of each small spacecraft. Each small spacecraftgenerates the rateless coded symbols directly from the rateless coded symbols received from other small spacecraft, as well as its own source symbols. It is proved in this paper that the upper bound of the system throughput is the same, whether there are decoding operations or not in the rateless coded cooperation stage. The cancellation of decoding operations is vital for the energy-constrained spacecrafts. Besides, the data with different levels of importance in the small spacecrafts is assigned different priority. Therefore, the data with high priority can be recovered at the destination more quickly than the data with low priority. The upper bound of the average system throughput and the complexity of the proposed RCC-P scheme are analyzed. Simulation results gives the comparison between the throughput of the proposed RCC-P scheme and that of the existing rateless code cooperation methods in multi-access channels, and effect of the priority assigned to data with different levels of importance. It is shown that with the same complexity, the proposed RCC-P scheme can obtain 13.1 percent and 18.7 percent throughput gain on average compared with the existing method, when it is applied for 2-to-1 and 4-to-1 spacecrafts multi-access channel respectively. The results also give that the data with high priority can be recovered when 13.9 percent rateless coded symbols are saving, compared to that of the data with low priority.