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A Quinary Coding and Matrix Structure Based Channel Hopping Algorithm for Blind Rendezvous in Cognitive Radio Networks

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Abstract : The multi-channel blind rendezvous problem in distributed cognitive radio networks (DCRNs) refers to how users in the network can hop to the same channel at the same time slot without any prior knowledge (i.e., each user is unaware of other users' information). The channel hopping (CH) technique is a typical solution to this blind rendezvous problem. In this paper, we propose a quinary coding and matrix structure-based CH algorithm called QCMS-CH. The QCMS-CH algorithm can guarantee the rendezvous of users using only one cognitive radio in the scenario of the asynchronous clock (i.e., arbitrary time drift between the users), heterogeneous channels (i.e., the available channel sets of users are distinct), and symmetric role (i.e., all users play a same role). The QCMS-CH algorithm first represents a randomly selected channel (denoted by R) as a fixed-length quaternary number. Then it encodes the quaternary number into a quinary bootstrapping sequence according to a carefully designed quaternary-quinary coding table with the prefix "R00". Finally, it builds a CH matrix column by column according to the bootstrapping sequence and six different types of elaborately generated subsequences. The user can access the CH matrix row by row and accordingly perform its channel, hoping to attempt rendezvous with other users. We prove the correctness of QCMS-CH and derive an upper bound on its Maximum Time-to-Rendezvous (MTTR). Simulation results show that the QCMS-CH algorithm outperforms the state-of-the-art in terms of the MTTR and the Expected Time-to-Rendezvous (ETTR).

Keywords : channel hopping, blind rendezvous, cognitive radio networks, quaternary-quinary coding
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