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## **Distributed Consensus Estimator of Hierarchical Network Transfer Function in WPNC Networks**

Abstract—Wireless Physical Layer Network Coding (WPNC) network nodes determine their front-end, back-end, and node processing operation depending on the knowledge of the global Hierarchical Network Transfer Function (H-NTF). The H-NTF can be derived from the network connectivity state and it is essential in determining how to perform hierarchical decoding, what hierarchical network coding function to use, and how to encode the Network Coded Modulation at each node. The data payload in WPNC network uses a common signal space of mutually interacting signals that superpose on the receive nodes. There are no orthogonalized communication links that would allow traditional control-data signaling based approaches to determine the network state. Also, the procedure where each node establishes a complete picture of the network state must be performed before the payload phase and with superposing non-orthogonal pilot signals that fully respect the WPNC paradigm. This paper proposes a distributed consensus-based estimator of the network state which operates on a common signal space shared by all nodes in the network. The algorithm allows each node to find the global network state based only on local neighbor superposed pilot observation.

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