

# A Signal-Space Aligned Network Coding Approach to Distributed MIMO

Abstract:

Abstract—This paper studies an uplink distributed MIMO (DMIMO) system that consists of  $K$  users and  $K$  distributed base stations (BSs), where the BSs are connected to a central unit (CU) via independent rate-constrained backhaul (BH) links. We propose a new signal-space aligned network coding scheme. First, a network coding generator matrix is selected subject to certain structural properties. Next, distributed linear precoding is employed by the users to create aligned signal-spaces at the BSs, according to the pattern determined by the network coding generator matrix. For each aligned signal-space at a BS, physical-layer network coding is utilized to compute the corresponding network-coded (NC) messages, where the actual number of NC messages forwarded to the CU is determined by the BH rate-constraint. We derive an achievable rate of the proposed scheme based on the existence of the NC generator matrix and signal-space alignment precoding matrices. For DMIMO with two and three BSs, the achievable rates and degrees of freedom (DoF) are evaluated and shown to outperform existing schemes.