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*Representations of the Multicast Network Problem*

We approach the problem of linear network coding for multicast networks from different perspectives. We introduce the code graph of a network, a simplified directed graph that maintains the information essential to understanding the coding properties of the network. One of the main problems in network coding is to understand when the capacity of a multicast network is achieved with linear network coding over a finite field of size  $q$ . We explain how this problem can be interpreted in terms of rational points on certain algebraic varieties.