Codes for MT–MFSK Signalling, and Configurations in Designs

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Multiple access methods for communication channels require codes in order to represent a number of possible messages for each user in a large population. MT–MFSK signalling is a prototypical example of a multiple access technique, which is used primarily for radio communications with bursty traffic. The codes are uniform weight, and so arise from uniform hypergraphs. Requirements on orthogonality of transmitted signals lead to specific hypergraphs, called packings. Then maximizing the number of transmitters lead to extremal packings, which are combinatorial designs or their close relatives.

In this talk, we examine the design of codes of weight three for MT–MFSK signalling. We outline the application of some classical and some new results in combinatorial design theory, and describe some local optimization techniques to construct codes when the theory fails to provide one. Remarkably, the codes constructed have a surprising connection with recent research on configurations in combinatorial designs.