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Balancedly splittable Hadamard matrices

A Hadamard matrix of order n is said to be balancedly splittable if by a suitable permutation of the rows it can be splitted in two parts such as

$$\begin{pmatrix} H_1 \\ H_2 \end{pmatrix},$$

where H_1 is an $\ell \times n$ matrix, $\ell < n$, and $H_1^T H_1$ has at most two distinct off diagonal entries.

Feasible parameters and construction methods will be presented. Applications include some symmetric association schemes with five and six classes.

This is a joint work with Sho Suda.