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Constructions and uses of incomplete pairwise balanced designs

I will describe recent work with Peter Dukes on incomplete pairwise balanced designs, $\text{IPBD}((v, w), K)$. We provide explicit constructions for such designs whenever v and w satisfy the usual divisibility conditions, have ratio $v/w > k - 1 + \epsilon$, for $k = \min K$ and $\epsilon > 0$, and are sufficiently large (depending on K and ϵ). As a consequence, we obtain new results for several related designs such as IMOLS and GDDs. Of particular interest are the large number of applications that illustrate the power of using IPBDS as templates. I will emphasize these new applications in my talk.