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Novák's conjecture on cyclic Steiner triple systems and its generalization

Novák conjectured in 1974 that for any cyclic Steiner triple systems of order v with $v \equiv 1 \pmod 6$, it is always possible to choose one block from each block orbit so that the chosen blocks are pairwise disjoint.

In this talk, we shall consider the generalization of this conjecture to cyclic (v, k, λ)-designs with $1 \leq \lambda \leq k-1$. Superimposing multiple copies of a cyclic symmetric design shows that the generalization cannot hold for all v, but we conjecture that it holds whenever v is sufficiently large compared to k. We confirm that the generalization of the conjecture holds when v is prime and $\lambda = 1$ and also when $\lambda \leq (k-1)/2$ and v is sufficiently large compared to k. As a corollary, we show that for any $k \geq 3$, with the possible exception of finitely many composite orders v, every cyclic $(v, k, 1)$-design without short orbits is generated by a $(v, k, 1)$-disjoint difference family.

This is joint work with Daniel Horsley and Xiaomiao Wang.