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Cyclic m-cycle systems of near-complete graphs

There are certain straightforward necessary conditions for a graph to be decomposable into cycles of a fixed length m: the valency of every vertex must be even; the number of edges must be divisible by the cycle length. The graphs that are most natural to try to decompose into cycles, are complete graphs K_n. If n is even, then a 1-factor must be removed from the graph so that it meets the first necessary condition, and the resulting graph is denoted by $K_n - I$.

Alspach, Gavlas, and Šajna proved that the necessary conditions are sufficient to ensure an m-cycle decomposition of K_n, or of $K_n - I$. Since K_n has a great deal of symmetry, it is natural to ask whether or not some of that symmetry can carry over into an m-cycle decomposition. We let ρ denote the n-step rotation of the complete graph K_n, or of $K_n - I$ (where the 1-factor that has been removed is chosen so that the graph still has n-step rotational symmetry). An m-cycle system is called cyclic, if for any cycle C in the system, $\rho(C)$ is also in the system.

I will discuss results on cyclic m-cycle systems of K_n and more particularly $K_n - I$, including recent results dealing with the case where m is an even divisor of n.