Dissertation Defense

On Cycles, Chorded Cycles, and Degree Conditions

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Abstract: Sufficient conditions to imply the existence of certain substructures in a graph are of considerable interest in extremal graph theory, and conditions that guarantee a large set of cycles or chorded cycles are a recurring theme. This dissertation explores different degree sum conditions that are sufficient for finding a large set of vertex-disjoint cycles or a large set of vertex-disjoint chorded cycles in a graph.

For an integer $t \geq 1$, let $\sigma_t(G)$ be the smallest sum of degrees of t independent vertices of G. We first prove that if a graph G has order at least $7k + 1$ and degree sum condition $\sigma_4(G) \geq 8k - 3$, with $k \geq 2$, then G contains k vertex-disjoint cycles. Then, we consider an equivalent condition for chorded cycles, proving that if G has order at least $11k + 7$ and $\sigma_4(G) \geq 12k - 3$, with $k \geq 2$, then G contains k vertex-disjoint chorded cycles. We prove that the degree sum condition in each result is sharp. Finally, we conjecture generalized degree sum conditions on $\sigma_t(G)$ for $t \geq 2$ sufficient to imply that G contains k vertex-disjoint cycles for $k \geq 2$ and k vertex-disjoint chorded cycles for $k \geq 2$. This is joint work with Ronald J. Gould and Kazuhide Hirohata.

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