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Complexity of H-coloring in hereditary graph classes

Let H be a fixed graph (with possible loops). In the graph homomorphism problem $\textsc{Hom}(H)$, for a given graph G we ask about the existence of a *homomorphism* from G to H (i.e., a function $f : V(G) \to V(H)$ such that if $uv \in E(G)$ then $f(u)f(v) \in E(H)$). If H is a k-clique, then the $\textsc{Hom}(H)$ problem is equivalent to the well-known k-COLORING problem, therefore, it can be seen as a natural generalization of graph coloring.

The $\textsc{Hom}(H)$ problem is known to be polynomial-time solvable when H is bipartite, and for all other graphs H it is NP-complete. However, if we restrict our input instances to be from some particular graph class, it may happen that for some non-bipartite H this problem becomes subexponential- or even polynomial-time solvable.

For graphs G and F, we say that G is F-free if it contains no copy of F as an induced subgraph. During my talk I will partially answer the question: for which pairs (F, H) the $\textsc{Hom}(H)$ problem (and its more general list version) can be solved in subexponential time.

This is joint work with Paweł Rzążewski.