Tiling edge-coloured graphs with few monochromatic bounded-degree graphs

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Erdős, Gyárfás and Pyber proved that the vertices of every r-edge-coloured K_n can be partitioned into a collection of at most $O(r^2 \log r)$ monochromatic cycles. It is very interesting that this number is independent of the size of the graph. We prove a similar result for a wide range of families other than cycles.

More precisely, we prove that for all integers $\Delta, r \geq 2$, there is a constant $C = C(\Delta, r) > 0$ such that the following is true for every family $\mathcal{F} = \{F_1, F_2, \ldots\}$ of graphs with $v(F_n) = n$ and $\Delta(F_n) \leq \Delta$ for every $n \in \mathbb{N}$. In every r-edge-coloured K_n, there is a collection of at most C monochromatic copies from $\mathcal{F}$ whose vertex-sets partition $V(K_n)$. This makes progress on a conjecture of Grinshpun and Sárközy.