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p-free flows

Let G be a digraph, M an abelian group, $\varphi : E(G) \to M$ a flow. We say φ is p-free if $\varphi(e_1) + \cdots + \varphi(e_k)$ is never zero for $1 \le k \le p$ and $e_1, \ldots, e_k \in E(G)$.

For $p = 1$ this is the nowhere-zero flow.

For $p = 2$ this is called antisymmetric flow.

Conjecture (Nešetřil, Šámal) For every $p \ge 1$ exists a K_p such that any orientation of an $(p+1)$-edge-connected graph has a p-free flow $\varphi : E(G) \to M$ where M is a group of order $\le K_p$.

True for $p = 1, 2$. (Jaeger; DeVos, Johnson and Seymour)

True for any p and $(2p+1)$-edge-connected graphs.

Open for other cases.