On regular handicap graphs

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(joint work with Petr Kovář)

Let $G = (V, E)$ be a simple graph on n vertices. A bijection $f : V \rightarrow 1, 2, \ldots, n$ is called *handicap labeling* if there exists an integer ℓ such that $\sum_{v \in N(u)} f(v) = \ell + f(u)$ for all $u \in V$, where $N(u)$ is the set of all vertices adjacent to u. A graph that admits a handicap labeling is called a *handicap graph*.

Handicap graphs can be used for scheduling incomplete round robin tournaments in which the sum of strengths of opponents of each team is increasing with the strength of the team. For r-regular graphs such labeling is possible only if r and n have different parity. We present a construction of r-regular handicap graphs for almost all feasible $r < n - 10$.