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Asymptotic density of graphs excluding a disconnected minor

For a graph $H$, let

$$c_\infty(H) = \lim_{n \to \infty} \left( \max \left| E(G) \right| / n \right),$$

where the maximum is taken over all graphs $G$ on $n$ vertices not containing $H$ as a minor. Thus $c_\infty(H)$ is the asymptotic maximum density of graphs not containing an $H$-minor. Employing a structural result of Eppstein, we prove new upper bounds on $c_\infty(H)$ for disconnected graphs $H$.

The case when $H = sK_r$, that is when $H$ is a disjoint union of $s$ copies of the complete graph on $r$ vertices, is of particular interest. Thomason has shown that

$$c_\infty(sK_r) = s(r - 1) - 1$$

for $s = \Omega(r \sqrt{\log r})$. We show that the same conclusion holds for $s = \Omega(\log^{3/2} r)$, which is best possible up to the power of the logarithm.

Based on joint work with Yingjie Qian.