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Asymptotic density of graphs excluding a disconnected minor

For a graph H, let

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

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.