Towards the Overfull Conjecture

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Abstract:

Let G be a simple graph with maximum degree denoted as $\Delta(G)$. An overfull subgraph H of G is a subgraph satisfying the condition $|E(H)| > \Delta(G)\lfloor\frac{1}{2}|V(H)|\rfloor$. In 1986, Chetwynd and Hilton proposed the Overfull Conjecture, stating that a graph G with maximum degree $\Delta(G) > \frac{1}{3}|V(G)|$ has chromatic index equal to $\Delta(G)$ if and only if it does not contain any overfull subgraph. The Overfull Conjecture has many implications. For example, it implies a polynomial-time algorithm for determining the chromatic index of graphs G with $\Delta(G) > \frac{1}{3}|V(G)|$, and implies several longstanding conjectures in the area of graph edge colorings. In this paper, we make the first improvement towards the conjecture when not imposing a minimum degree condition on the graph: for any $0 < \epsilon \leq \frac{1}{22}$, there exists a positive integer n_0 such that if G is a graph on $n \geq n_0$ vertices with $\Delta(G) \geq (1-\epsilon)n$, then the Overfull Conjecture holds for G. The previous best result in this direction, due to Chetwynd and Hilton from 1989, asserts the conjecture for graphs G with $\Delta(G) \geq |V(G)| - 3$.