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Bounds for the twin-width of graphs

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Bonnet, Kim, Thomass\'{e}, and Watrigant (2020) introduced the twin-width of a graph. We show that the twin-width of an n-vertex graph is less than $(n + \sqrt{n \ln n} + \sqrt{n} + 2 \ln n)/2$, and the twin-width of an m-edge graph is less than $\sqrt{3m} + m^{1/4}\sqrt{\ln m}/(4 \cdot 3^{1/4}) + 3m^{1/4}/2$. Conference graphs of order n (when such graphs exist) have twin-width at least $(n-1)/2$, and we show that Paley graphs achieve this lower bound. We also show that the twin-width of the Erd\H{o}s-R\'{e}nyi random graph $G(n,p)$ with $1/n \leq p \leq 1/2$ is larger than $2p(1-p)n - (2\sqrt{2}+\varepsilon)\sqrt{p(1-p)n \ln n}$ asymptotically almost surely for any positive ε. Lastly, we calculate the twin-width of random graphs $G(n,p)$ with $p \leq c/n$ for a constant $c < 1$, determining the thresholds at which the twin-width jumps from 0 to 1 and from 1 to 2.

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