# LONGER CYCLES IN ESSENTIALLY 4-CONNECTED PLANAR GRAPHS 

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#### Abstract

A planar 3-connected graph $G$ is called essentially 4-connected if, for every 3 -separator $S$, at least one of the two components of $G-S$ is an isolated vertex. Jackson and Wormald proved that the length $\operatorname{circ}(G)$ of a longest cycle of any essentially 4 -connected planar graph $G$ on $n$ vertices is at least $\frac{2 n+4}{5}$ and Fabrici, Harant and Jendrol improved this result to $\operatorname{circ}(G) \geq \frac{1}{2}(n+4)$. In the present paper, we prove that an essentially 4 -connected planar graph on $n$ vertices contains a cycle of length at least $\frac{3}{5}(n+2)$ and that such a cycle can be found in time $O\left(n^{2}\right)$.


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## References

[^0][1] M.B. Dillencourt, Polyhedra of small order and their Hamiltonian properties, J. Combin. Theory Ser. B 66 (1996) 87-122. doi:10.1006/jctb.1996.0008
[2] I. Fabrici, J. Harant and S. Jendrol', On longest cycles in essentially 4-connected planar graphs, Discuss. Math. Graph Theory 36 (2016) 565-575. doi:10.7151/dmgt. 1875
[3] B. Grünbaum and J. Malkevitch, Pairs of edge-disjoint Hamilton circuits, Aequationes Math. 14 (1976) 191-196. doi:10.1007/BF01836218
[4] B. Jackson and N.C. Wormald, Longest cycles in 3-connected planar graphs, J. Combin. Theory Ser. B 54 (1992) 291-321. doi:10.1016/0095-8956(92)90058-6
[5] D.P. Sanders, On paths in planar graphs, J. Graph Theory 24 (1997) 341-345. doi:10.1002/(SICI)1097-0118(199704)24:4〈341::AID-JGT6〉3.0.CO;2-O
[6] A. Schmid and J.M. Schmidt, Computing Tutte paths (2017), arXiv-preprint. https://arxiv.org/abs/1707.05994
[7] C.-Q. Zhang, Longest cycles and their chords, J. Graph Theory 11 (1987) 521-529. doi:10.1002/jgt.3190110409

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