Edge partition of planar graphs into two outerplanar graphs

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Abstract

An outerplanar graph is a graph that has a planar embedding in which all the vertices are in the outer-boundary. G.Chartrand, D.Geller and S.Hedetniemi defined the graphs with property P_n as the graphs having no subgraph homeomorphic to K_{n+1} or $K_{p,q}$, with $p = \lceil (n+2)/2 \rceil$ and $q = \lfloor (n+2)/2 \rfloor$. The graphs with property P_2, P_3 and P_4 are respectively the forests, the outerplanar graphs and the planar graphs. Chartrand *et al.* conjectured that every graph with property P_m can be edge partitioned into $m - n + 1$ graphs with property P_n. Gutin *et al.* proved that this conjecture does not hold in the general case. Here we prove the case where $m = 4$ and $n = 3$. This is, that any planar graph $G = (V, E)$ has a bipartition of its edge set, $E = A \cup B$, such that the two induced graphs, $G[A]$ and $G[B]$ are outerplanar.