Zero-Sum Magic and Null Sets of Planar Graphs

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For any $h \in \mathbb{N}$, a graph $G = (V, E)$ is said to be $h$-magic if there exists a labeling $l : E(G) \to \mathbb{Z}_h - \{0\}$ such that the induced vertex labeling $l^+ : V(G) \to \mathbb{Z}_h$ defined by

$$l^+(v) = \sum_{uv \in E(G)} l(uv)$$

is a constant map. When this constant is 0 we call $G$ a zero-sum $h$-magic graph. The null set of $G$ is the set of all natural numbers $h \in \mathbb{N}$ for which $G$ admits a zero-sum $h$-magic labeling. A graph $G$ is said to be uniformly null if every magic labeling of $G$ induces zero sum. In this paper we will identify the null sets of certain planar graphs.

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