# Characterizing Generalized Petersen Graphs with Locating Chromatic Number Five

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**Abstract**

Consider $G = (V, E)$ as the given connected graph and $c$ as the proper coloring of $G$ using k colors $1, 2, \ldots, k$ for some positive integer *k*. We denote $\Pi = \{C_1, C_2, ..., C_k\}$ as the partition of $V(G)$, where $C_i$ is the color class, the set of vertices that given the *i*-th color, for $i \in [1, k]$. For an arbitrary vertex $v \in V(G)$, the color code $c_{\Pi}(v)$ is defined as the ordered $k$-tuple $c_{\pi}(v) = (d(v, C_1), d(v, C_2), \ldots, d(v, C_k))$, where $d(v, C_i) = \min\{d(v, x) \mid x \in C_i\}$ for $i \in [1, k]$. If for every two vertices $u, v \in V(G)$, their color codes are different, $c_{\pi}(u) \neq c_{\pi}(v)$, then c is defined as the locating coloring of $G$ using *k* colors. The locating chromatic number of *G*, denoted by $\chi_L(G)$, is the minimum *k* such that *G* has a locating coloring. The generalized Petersen Graph $P_{n,k}, n \geq 3,\ 1 \leq k \leq \left\lceil \frac{n-1}{2} \right\rceil$, consists of an outer $n$-cycle $u_1, u_2, \ldots, u_n$, a set $n$ spokes $u_i v_i,\ 1 \leq i \leq n,$ and $n$ edges $v_i v_{i+k}$, with indices taken modulo *n*. In this paper, we characterize generalized Petersen graphs whose locating-chromatic number is 5.

*Keywords*: coloe code, locating chromatic number, generalized Petersen graph.