The $L(2, 1)$-labeling Problem from Graph Theoretic and Graph Algorithmic Approaches with Our Contributions

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The frequency assignment problem is to assign frequencies to a number of radio transmitters so that interfering transmitters are assigned frequencies with allowed separation. The frequency assignment problem has been extensively studied. Motivated by a variation of the frequency assignment problem, a generalization of the graph vertex coloring has been presented and is called an $L(2,1)$-labeling. More precisely, an $L(2,1)$-labeling of a graph is a function from the vertex set $V(G)$ to the set of all nonnegative integers such that $|f(x) - f(y)| \geq 2$ if $d(x, y) = 1$ and $|f(x) - f(y)| \geq 1$ if $d(x, y) = 2$. The $L(2,1)$-labeling number $\lambda(G)$ of $G$ is the smallest number $k$ such that $G$ has an $L(2,1)$-labeling with $\max\{f(v) : v \in V(G)\} = k$. In this work, we first give a survey of some results and methods on the $L(2,1)$-labeling problem from graph theoretic and graph algorithmic approaches. We then present some of our results in this area. We finally propose some future work to be done.

Keywords: frequency assignment, graph theory, graph algorithm