

## Multicolored Subgraphs in Properly Edge-colored Graphs

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### Abstract

A graph is said to be properly colored if there is an edge coloring of the graph such incident edges receive distinct colors. The minimum number of colors we use for the properly colored graph  $G$  is known as the chromatic index of  $G$ , denoted by  $\chi'(G)$ . Throughout of this talk, the graphs we consider are complete graphs. Therefore, the chromatic index of  $K_n$  will be  $n-1$  or  $n$  depending on  $n$  is even or odd.

A subgraph of a properly colored graph is a multicolored (rainbow or heterochromatic) subgraph provided all the edges of the subgraph receive distinct colors. It is interesting to know which kinds of multicolored subgraphs we can have inside a properly colored complete graph.

There are two aspects in looking for multicolored subgraphs: Designed or Un-designed. Clearly, if we design the edge coloring beforehand, then we have more knowledge to know “who are hiding there?” On the other hand, if the edge-coloring was obtained arbitrarily, then finding multicolored subgraphs with good structure is going to be much harder.

In this talk, several known results on both aspects will be presented and I shall also talk about a couple of ongoing research in looking for good multicolored subgraphs. Especially, for designed edge-coloring, we can decompose the complete graph into suitable isomorphic multicolored subgraphs for several classes of graphs. Hence, we have multicolored graph designs.