

## **Circular Representations of Simple Connected Graphs & Delta Graph Minimum Semidefinite Rank**

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In graph theory, various combinatorial methods are utilized to test results. Some of them are based upon the coloring of the vertices and the computation of parameters determined by the minimum obtained in some combinatorial process, of graph coverage through families of other graphs, by separation into subfamilies of induced graphs, etc. These techniques take a large amount of computation as they have to analyze exhaustively the graph to obtain the desired parameter. If the graph has a small number of vertices, the computation can be accomplished with greater or lesser complexity, requiring in most cases a large amount of time. Nonetheless, when working on graphs with a very large number of vertices or with families of infinite graphs, these techniques can become very challenging. A great number of vertices necessarily implies a large amount of time process and depending on how complicated the computations are, obtaining results may become a hard task even by using high performance computers (HPC) and the most widely used programs available. Furthermore, since the representation of a graph does not impose any restriction especially on the location of the vertices or the arc length shape of their edges, how the graph is represented could further perplex its study. Thus, it is necessary to represent a graph in such a manner as to identify features such as connectivity, symmetries, induced graphs, maximum paths, etc. Here, a method is given, to represent a graph  $G$  called simple connected in the clockwise direction. This technique allows not only to visualize the graph in a more orderly manner, but also to obtain more information about it, its induced subgraphs and their complementary graph. It is also presented how this technique allows the demonstration of the delta conjecture for some infinite families of simple connected graphs, thus constituting a valuable tool in the study of graph theory.

Keywords: simple-connected graph, minimum semidefinite rank, delta conjecture, orthogonal representation.