Minimum Reload Cost Cycle Cover in Complete Graphs[1]

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(joint work with Didem Gözüpek and Sibel Özkan)

The *reload cost* concept occurs along a path on an edge-coloured graph while traversing through an internal vertex via two consecutive edges of different colors. This concept is used in many areas such as transportation networks, telecommunication networks, energy distribution networks.

In [1], *Minimum Reload Cost Cycle Cover* (MinRC3) problem is introduced as finding a set of vertex-disjoint cycles spanning all vertices with minimum reload cost, and it is proved that MinRC3 is strongly NP-Hard and is not approximable within $1/\epsilon$ for any $\epsilon > 0$ even when the number of colors is 2, the reload costs are symmetric and satisfy the triangle inequality. We focus on MinRC3 problem in a special graphs class, the complete graphs. We show that MinRC3 is strongly NP-Hard and is not approximable within $1/\epsilon$ for any $\epsilon > 0$ on complete graphs, even when the number of colors is 3, the reload costs are symmetric and satisfy the triangle inequality.

A k-edge-coloring of G is said to be *equitable* if for each vertex $v \in V(G)$ and for each pair of colours $i, j \in Z_k$, $||c_i(v)| - |c_j(v)|| \leq 1$ where $c_i(v)$ is the set of edges with color i that is incident to v. In this work, we focus on the MinRC3 problem in complete graphs with equitable 2-edge-coloring. We prove that the minimum reload cost cycle cover is exactly zero on any equitable 2-edge-coloring of a complete graph. Furthermore, the constructive nature of our proof yields a polynomial-time algorithm, which finds the minimum reload cost cycle cover in any complete graph with equitable 2-edge-coloring.

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References

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