Star Edge Coloring of Subcubic Multigraphs

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The *star chromatic index* of a multigraph G, denoted $\chi'_s(G)$, is the minimum number of colors needed to properly color the edges of G such that no path or cycle of length four is bi-colored. A multigraph G is *star k-edge-colorable* if $\chi'_s(G) \leq k$. Dvořák, Mohar and Šámal proved that every subcubic multigraph is star 7-edge-colorable, and conjectured in the same paper that every subcubic multigraph should be star 6-edge-colorable. We will present our resent progress on this conjecture. We first show that the problem of deciding whether a subcubic multigraph is star 3-edge-colorable is NP-complete. We then establish some structure results on subcubic multigraphs G with $\chi'_s(G) > k$ and $\chi'_s(G - v) \leq k$ for any $v \in V(G)$, where $k \in \{5, 6\}$. We finally apply our structure results, together with a simple discharging method, to prove that every subcubic multigraph G is star 6-edge-colorable if $mad(G) < 5/2$, and star 5-edge-colorable if $mad(G) < 24/11$.