**Graph-edge Pairs with the 3-Dimensional Single Interval Property**

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Characterizing the configuration space of a flexible linkage in Euclidean dimension d is a difficult problem that is important for efficient algorithmic representation and traversal in numerous applications. Current methods are ad hoc and inefficient. We build upon a branched covering space characterization called “Cayley convexification” proposed by Sitharam and Gao who demonstrated its close relationship to a finite forbidden minor “d-flattenability” property of graphs first defined by Belk and Connelly. Specifically for d=2, Sitharam and Gao characterized graphs with underlying linkages whose 2-dimensional configuration space is always convex when represented using the lengths attained by a chosen set of non-edges. Their first step was to characterize single non-edges whose attainable length is a single interval. For d = 3, we give such a characterization. While our current proof for d= 3 relies strongly on the specific forbidden minors of 3-flattenable graphs listed by Belk and Connelly, we conjecture a characterization (and a type of proof) for general dimensions d based only on the finite forbidden minor property of d-flattenability without relying on knowing the specific forbidden minors.

Keywords: configuration space, graphs, flattenability, forbidden minors