

How to avoid collisions in 3D-realizations for moving graphs

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Abstract: If we parameterize the positions of all vertices of a given graph in the plane such that distances between adjacent vertices are fixed, we obtain a moving graph. An L-linkage is a realization of a moving graph in 3D-space, by representing edges using horizontal bars and vertices by vertical sticks. Vertical sticks are parallel revolute joints, while horizontal bars are links connecting them. We give a sufficient condition for a moving graph to have a collision-free L-linkage. Furthermore, we provide an algorithm guiding the construction of such a linkage when the moving graph fulfills the sufficient condition, via computing a height function for the edges (horizontal bars). In particular, we prove that any Dixon-1 moving graph has a collision-free L-linkage and no Dixon-2 moving graphs have collision-free L-linkages, where Dixon-1 and Dixon-2 moving graphs are two classic families of moving graphs.