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Global Rigidity II

Generic global rigidity in the plane is equivalent to vertex 3-connectedness and generic redundant rigidity (the framework remains rigid after the removal of any edge) by result of Berg and Jordan, and Jackson and Jordan; this provides a deterministic polynomial-time algorithm to determine generic global rigidity in the plane. There is a certain class of graphs, generic bar-and-body frameworks, for which there is a deterministic polynomial-time algorithm for generic local rigidity. Our result is that bar-and-body frameworks in d-space are generically globally rigid if and only if they are generically redundantly rigid. Thus generic global rigidity for this class of graphs can be determined by a deterministic polynomial-time algorithm in all dimensions by results of Tay and Tay and Whiteley.

But, unlike the condition for generic local rigidity, it is difficult determine what special configurations to avoid to be sure to have global rigidity. My hope was to find special classes of graphs and configurations that are globally rigid even when perturbed slightly. But there are counterexamples to this attempt in higher dimensions, using the property that a graph is generically globally rigid in d-space if and only if its cone is generically globally rigid in $(d+1)$-space (a joint result with W. Whiteley mentioned in a previous talk), generic local rigidity is preserved by vertex splitting (a result of W. Whiteley), the necessity of the maximal rank of a stress matrix (due to Gortler, Healy, and Thurston) and a construction due to Jiayang Jiang and Sam Frank.