

Rigidity theory and the concept of global rigidity

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Abstract

A framework is a mathematical model of a physical structure: Each vertex of the framework corresponds to a ball joint located in space, the edges correspond to rigid rods connecting the joints. A very general class of physical structures, from scaffolding or bridges to glasses, ceramics, or molecules of proteins, may be described this way. The mathematical task is to develop a method for predicting rigidity without building a model. Geometry and combinatorics provide the fundamental tools. Although rigidity has been studied since the time of Maxwell (1864), it is only in the last 25 years that it has begun to find applications in the basic sciences. We will describe combinatorial tools for planar rigidity, in particular the new characterization of global rigidity, and discuss algorithmic questions as well as problems arising in the attempts to generalize these results from the plane to 3-space.