Geometry Seminar
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Room 613, Courant Institute
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# The slider pinning problem

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**Abstract**

A Laman mechanism is a flexible planar bar-and-joint framework with $m \leq 2n-3$ edges and exactly $k = 2n-m$ internal degrees of freedom. The mechanism can be completely immobilized by constraining the coordinates of some of the vertices to lie on fixed straight lines. The *Slider Pinning* problems asks for the minimum set of sliders that will pin a given mechanism. A particular degenerate case is to restrict the lines to be axis-parallel.

We give a combinatorial characterization of the minimal slider-pinned Laman mechanisms in terms of **sparse graphs** with **map-graph decompositions**. A previous result of ours, on pebble game with colors, gives then an $O(n^2)$ algorithm for finding a slider pinning. The rigidity result is based on a new proof of Laman's theorem illustrating an algebraic property of the tree decompositions of minimally rigid graphs. We relate its monomial expansion of a maximum rank determinant of the rigidity matrix to certain colorings and orientations of the graph and show that these terms cannot all cancel exactly when the underlying graph is rigidity independent.

This is joint work with Audrey Lee and Louis Theran.

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