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Infinite classes of movable (n_4) configurations using Poncelet polygons

An (n_k) geometric configuration is a collection of n points and n straight lines, typically in the Euclidean plane, so that every point lies at the intersection of k lines and every line passes through k points. The modern study of configurations began in 1990, when Branko Grünbaum and John Rigby published the first geometric realization of any (n_4) configuration. In particular, they realized a (21_4) configuration (previously studied as a combinatorial configuration by Felix Klein) using properties of regular heptagons. It had long been assumed that this configuration is not movable: it is impossible to fix four noncollinear points of the configuration and move a fifth point in such a way that all the other incidences of the configuration are retained. However, this assumption turns out to be false—the (21_4) Grünbaum-Rigby configuration is movable! Its movability relies on a deep relationship between the construction technique that produces the heptagonal realization, conics, and the structure of Poncelet polygons. Poncelet polygons provide a framework for showing that all trivial celestial configurations, of which the Grünbaum-Rigby configuration is the smallest example, are movable. This is joint work with Gábor Gévay, Jürgen Richter-Gebert, and Serge Tabachnikov.