

Jeff Lagarias, 57th Texas Topology and Geometry Conference

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Configuration Spaces and Materials Science

Abstract

Configuration spaces of points on a manifold were studied in topology beginning in the 1960's. They appear in many fields, including algebraic geometry, graph theory and robotics, and here materials science. This talk discusses constrained configuration spaces of N spheres of equal radius r touching a central sphere of radius 1. These topological spaces form a family with r as the constraint parameter, and with $r = 0$ being the classical configuration space. They can be viewed as toy models for studying some aspects of granular materials, having a packing density of spherical caps determined by N and r (the Tammes problem), with N acting as a discretization parameter. The special case $N = 12$ and radius $r = 1$ has a long history in connection with the three-dimensional sphere packing problem and is of special interest. The talk discusses the topology and geometry of these spaces for small N as the parameter r varies, with particular emphasis on the case $N = 12$ with $r = 1$. (This is joint work with Rob Kusner, Woden Kusner and Senya Shlosman.)