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5. Differential Geometry and Global Analysis

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The stable 4-dimensional geometry of the real Grassmann manifolds

In their fundamental paper on *Calibrated geometries* in 1982, Reese Harvey and Blaine Lawson, discussing future global applications, posed the problem of determining the subvarietis of the real Grassmann manifolds G_kR^n of oriented k-planes through the origin in R^n, which can be shown to be volumeminimizing in their homology classes by using as calibrations the invariant forms representing the universal Pontryagin classes. We carray out this program here for the first Pontryagin form, using it as a calibration to determine volume-minimizing 4-dimensional cycles in all real Grassmann manifolds, and learning that their 4-dimensional geometry stabilizes immediately after the Grassmannian G_4R^8.