

Summary

A physically motivated axiom system for a synthetic geometry, dubbed physical geometry, has been presented which it is hoped might lead to mathematics of use in gravitational theory.

A signed distance measure based on orientation was introduced. By this means direction become a basic concept in the theory.

By considering the way distances must behave in order to satisfy the triangle inequality the important concept of an angle derivative was discovered. This made it possible to demonstrate that a measure of direction exists. And it was used to define perpendicularity and point out non-Euclidean possibilities in the theory.

This thesis was the introductory part of a larger work which continues by introducing a concept of tangent space based on physical ideas. The study of this tangent space constitutes the remainder of the work. It includes the following topics. The introduction of a function (called the Pythagorean function) characteristic of the tangent space. The development of a more general trigonometry. The proof of the existence of an area function. The derivation of the differential equations which govern rotation. The derivation of the differential equations (the master equations) satisfied by the parameters of the theory which characterize its non-Euclidean features. The demonstration that all the quantities of the theory can be reduced to a single arbitrary Pythagorean function. And the derivation of the most general isotropic tangent space.

The next logical direction to explore is the relation between the form of the tangent space and that of the general physical geometry. This might include trying to develop a “manifold theory” based on the non-Euclidean isotropic tangent space.