

## <<黎曼-芬斯勒几何导论>>

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### 前言

The subject matter of this book had its genesis in Riemann's 1854 "habilitation" address : "Über die Hypothesen , welche der Geometrie zu Grundeliegen" ( On the Hypotheses , which lie at the Foundations of Geometry ) . Volume II of Spivak's Differential Geometry contains an English translation of this influential lecture , with a commentary by Spivak himself. Riemann , undoubtedly the greatest mathematician of the 19th century , aimed at introducing the notion of a manifold and its structures. The problem involved great difficulties. But , with hypotheses on the smoothness of the functions in question , the issues can be settled satisfactorily and there is now a complete treatment. Traditionally , the structure being focused on is the Riemannian metric , which is a quadratic differential form. Put another way , it is a smoothly varying family of inner products , one on each tangent space. The resulting geometry — Riemannian geometry — has undergone tremendous development in this century. Areas in which it has had significant impact include Einstein's theory of general relativity , and global differential geometry. In the context of Riemann's lecture , this restriction to a quadratic differential form constitutes only a special case. Nevertheless , Riemann saw the great merit of this special case , so much so that he introduced for it the curvature tensor and the notion of sectional curvature. Such was done through a Taylor expansion of the Riemannian metric. The Riemann curvature tensor plays a major role in a fundamental problem. Namely : how does one decide , in principle , whether two given Riemannian structures differ only by a coordinate transformation ?

This was solved in 1870 , independently by Christoffel and Lipschitz , using different methods and without the benefit of tensor calculus. It was almost 50 years later , in 1917 , that Levi-Civita introduced his notion of parallelism ( equivalent to a connection ) , thereby giving the solution a simple geometrical interpretation.

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## 内容概要

The subject matter of this book had its genesis in Riemann's 1854 "habilitation" address : "Über die Hypothesen , welche der Geometrie zu Grundeliegen" ( On the Hypotheses , which lie at the Foundations of Geometry ) . Volume II of Spivak's Differential Geometry contains an English translation of this influential lecture , with a commentary by Spivak himself. Riemann , undoubtedly the greatest mathematician of the 19th century , aimed at introducing the notion of a manifold and its structures. The problem involved great difficulties. But , with hypotheses on the smoothness of the functions in question , the issues can be settled satisfactorily and there is now a complete treatment. Traditionally , the structure being focused on is the Riemannian metric , which is a quadratic differential form. Put another way , it is a smoothly varying family of inner products , one on each tangent space. The resulting geometry —— Riemannian geometry —— has undergone tremendous development in this century. Areas in which it has had significant impact include Einstein's theory of general relativity , and global differential geometry. In the context of Riemann's lecture , this restriction to a quadratic differential form

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