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AN INTRODUCTION TO INFINITE-DIMENSIONAL DIFFERENTIAL GEOMETRY

Introducing foundational concepts in infinite-dimensional differential geometry beyond Banach manifolds, this text is based on Bastiani calculus. It focuses on two main areas of infinite-dimensional geometry: infinite-dimensional Lie groups and weak Riemannian geometry, exploring their connections to manifolds of (smooth) mappings. Topics covered include diffeomorphism groups, loop groups and Riemannian metrics for shape analysis. Numerous examples highlight both surprising connections between finite- and infinite-dimensional geometry, and challenges occurring solely in infinite dimensions. The geometric techniques developed are then showcased in modern applications of geometry such as geometric hydrodynamics, higher geometry in the guise of Lie groupoids and rough path theory. With plentiful exercises, some with solutions, and worked examples, this will be indispensable for graduate students and researchers working at the intersection of functional analysis, non-linear differential equations and differential geometry. This title is also available as open access on Cambridge Core.

Alexander Schmeding is Associate Professor in Mathematics at Nord University at Levanger.

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ALEXANDER SCHMEDING
Nord University, Levanger

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