

Stochastic Analysis on Manifolds

Probability theory has become a convenient language and a useful tool in many areas of modern analysis. The main purpose of this book is to explore part of this connection concerning the relations between Brownian motion on a manifold and analytical aspects of differential geometry. A dominant theme of the book is the probabilistic interpretation of the curvature of a manifold. The book begins with a brief review of stochastic differential equations on Euclidean space. After presenting the basics of stochastic analysis on manifolds, the author introduces Brownian motion on a Riemannian manifold and studies the effect of curvature on its behavior. He then applies Brownian motion to geometric problems and vice versa, using many well-known examples, e.g., short-time behavior of the heat kernel on a manifold and probabilistic proofs of the Gauss-Bonnet-Chern theorem and the Atiyah-Singer index theorem for Dirac operators. The book concludes with an introduction to stochastic analysis on the path space over a Riemannian manifold.



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