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Nota di contenuto	Preface; Contents; 1. Preliminaries; 1.1 Riemannian manifold; 1.1.1 Differentiable manifold; 1.1.2 Riemannian manifold; 1.1.3 Some formulae and comparison results; 1.2 Riemannian manifold with boundary; 1.3 Coupling and applications; 1.3.1 Transport problem and Wasserstein distance; 1.3.2 Optimal coupling and optimal map; 1.3.3 Coupling for stochastic processes; 1.3.4 Coupling by change of measure; 1.4 Harnack inequalities and applications; 1.4.1 Harnack inequality; 1.4.2 Shift Harnack inequality; 1.5 Harnack inequality and derivative estimate 1.5.1 Harnack inequality and entropy-gradient estimate 1.5.2 Harnack inequality and L <sub>2</sub> -gradient estimate; 1.5.3 Harnack inequalities and gradient-gradient estimates; 1.6 Functional inequalities and applications; 1.6.1 Poincaré type inequality and essential spectrum; 1.6.2 Exponential decay in the tail norm; 1.6.3 The F-Sobolev inequality; 1.6.4 Weak Poincaré inequality; 1.6.5 Equivalence of irreducibility and weak Poincaré inequality; 2. Diffusion Processes on Riemannian Manifolds without Boundary; 2.1 Brownian motion with drift; 2.2 Formulae for P <sub>t</sub> and Ric <sub>Z</sub> 2.3 Equivalent semigroup inequalities for curvature lower bound 2.4 Applications of equivalent semigroup inequalities; 2.5 Transportation-cost inequality; 2.5.1 From super Poincaré to weighted log-Sobolev

inequalities; 2.5.2 From log-Sobolev to transportation-cost inequalities; 2.5.3 From super Poincare to transportation-cost inequalities; 2.5.4 Super Poincare inequality by perturbations; 2.6 Log-Sobolev inequality: Different roles of Ric and Hess; 2.6.1 Exponential estimate and concentration of; 2.6.2 Harnack inequality and the log-Sobolev inequality  
2.6.3 Hypercontractivity and ultracontractivity 2.7 Curvature-dimension condition and applications; 2.7.1 Gradient and Harnack inequalities; 2.7.2 HWI inequalities; 2.8 Intrinsic ultracontractivity on non-compact manifolds; 2.8.1 The intrinsic super Poincare inequality; 2.8.2 Curvature conditions for intrinsic ultracontractivity; 2.8.3 Some examples; 3. Reflecting Diffusion Processes on Manifolds with Boundary; 3.1 Kolmogorov equations and the Neumann problem; 3.2 Formulae for  $P_t$ ,  $Ric_Z$  and  $I$ ; 3.2.1 Formula for  $P_t$ ; 3.2.2 Formulae for  $Ric_Z$  and  $I$ ; 3.2.3 Gradient estimates  
3.3 Equivalent semigroup inequalities for curvature condition and lower bound of  $I$ ; 3.3.1 Equivalent statements for lower bounds of  $Ric_Z$  and  $I$ ; 3.3.2 Equivalent inequalities for curvature-dimension condition and lower bound of  $I$ ; 3.4 Harnack inequalities for SDEs on  $R^d$  and extension to nonconvex manifolds; 3.4.1 Construction of the coupling; 3.4.2 Harnack inequality on  $R^d$ ; 3.4.3 Extension to manifolds with convex boundary; 3.4.4 Neumann semigroup on non-convex manifolds; 3.5 Functional inequalities; 3.5.1 Estimates for inequality constants on compact manifolds  
3.5.2 A counterexample for Bakry-Emery criterion

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#### Sommario/riassunto

Stochastic analysis on Riemannian manifolds without boundary has been well established. However, the analysis for reflecting diffusion processes and sub-elliptic diffusion processes is far from complete. This book contains recent advances in this direction along with new ideas and efficient arguments, which are crucial for further developments. Many results contained here (for example, the formula of the curvature using derivatives of the semigroup) are new among existing monographs even in the case without boundary.

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