



# Sobolev Inequalities, Heat Kernels under Ricci Flow, and the Poincare Conjecture

*Qi S. Zhang*

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Focusing on Sobolev inequalities and their applications to analysis on manifolds and Ricci flow, **Sobolev Inequalities, Heat Kernels under Ricci Flow, and the Poincaré Conjecture** introduces the field of analysis on Riemann manifolds and uses the tools of Sobolev imbedding and heat kernel estimates to study Ricci flows, especially with surgeries. The author explains key ideas, difficult proofs, and important applications in a succinct, accessible, and unified manner.

The book first discusses Sobolev inequalities in various settings, including the Euclidean case, the Riemannian case, and the Ricci flow case. It then explores several applications and ramifications, such as heat kernel estimates, Perelman's  $W$  entropies and Sobolev inequality with surgeries, and the proof of Hamilton's little loop conjecture with surgeries. Using these tools, the author presents a unified approach to the Poincaré conjecture that clarifies and simplifies Perelman's original proof.

Since Perelman solved the Poincaré conjecture, the area of Ricci flow with surgery has attracted a great deal of attention in the mathematical research community. Along with coverage of Riemann manifolds, this book shows how to employ Sobolev imbedding and heat kernel estimates to examine Ricci flow with surgery.

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