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This monograph is a unified presentation of several theories of finding explicit formulas for heat kernels for both elliptic and sub-elliptic operators. These kernels are important in the theory of parabolic operators because they describe the distribution of heat on a given manifold as well as evolution phenomena and diffusion processes.

The work is divided into four main parts: Part I treats the heat kernel by traditional methods, such as the Fourier transform method, paths integrals, variational calculus, and eigenvalue expansion; Part II deals with the heat kernel on nilpotent Lie groups and nilmanifolds; Part III examines Laguerre calculus applications; Part IV uses the method of pseudo-differential operators to describe heat kernels.

Topics and features:

• Comprehensive treatment from the point of view of distinct branches of mathematics, such as stochastic processes, differential geometry, special functions, quantum mechanics, and PDEs;

• Novelty of the work is in the diverse methods used to compute heat kernels for elliptic and sub-elliptic operators;

• Most of the heat kernels computable by means of elementary functions are covered in the work;

• Self-contained material on stochastic processes and variational methods is included.

Heat Kernels for Elliptic and Sub-elliptic Operators is an ideal reference for graduate students, researchers in pure and applied mathematics, and theoretical physicists interested in understanding different ways of approaching evolution operators.