

Diffusion processes with generators of generalized divergence form

By

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§ 0. Introduction.

In this paper we shall discuss a certain class of diffusion processes with singular coefficients. Our class contains the class of divergence form. Hence we call it generalized divergence form (G.D.F. in abbreviation).

G.D.F. have some applications to problems arising from fluid mechanics. Indeed, the Burgers process ([12]) and the vortex process are of generalized divergence form. Especially the vortex process is an example of generalized divergence form which is not of divergence form ([3], [11], [13]). Since the coefficients of these diffusion processes are singular, the construction is not easy. Our results are useful to construct such diffusion processes and also applicable for a homogenization problem ([8], [9]).

A differentiable operator $A = \sum_{i,j=1}^n \nabla_i a_{ij} \nabla_j$, $\nabla_i = \frac{\partial}{\partial x_i}$, is said to be a divergence form if $a_{ij}(t, x)$ are measurable functions satisfying

$$(0.1) \quad \lambda^{-1} |\xi|^2 \leq \sum_{i,j=1}^n a_{ij} \xi_i \xi_j, \quad \xi = (\xi_i)$$
$$|a_{ij}| \leq \mu.$$

Fundamental solutions of parabolic equations in a divergence form have been researched by many mathematicians. Especially important theoretical improvements were done by Nash [7] and Moser [6]. The most remarkable result was obtained by Aronson [1]. He showed the following estimate: Let $p(s, x, t, y)$ be a fundamental solution of $\nabla_t - A$. Then

$$(0.2) \quad C_1 t^{-n/2} \exp[-C_1 |x-y|^2/(t-s)] \leq p(s, x, t, y)$$
$$\leq C_2 t^{-n/2} \exp[-C_2 |x-y|^2/(t-s)]$$

for all $0 < t-s < \infty$, $x, y \in R^n$, where C_1, \dots, C_2 are positive constants depending only on λ, μ and n . It is one of our main purpose to show that (0.2) is also valid in the case of G.D.F..

Now we introduce a notion of generalized divergence form. Let $a_{ij}(t, x)$, $c_{ij}(t, x)$ ($i, j=1, 2, \dots, n$) be measurable functions defined on $[0, \infty) \times R^n$ and

Generalized Diffusion Processes

Marcel A. Müller



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Functional Analysis in Markov Processes M. Fukushima, 2006-11-14

Stochastic Analysis and Partial Differential Equations Gui-Qiang Chen, Elton P. Hsu, Mark A. Pinsky, 2007 This book is a collection of original research papers and expository articles from the scientific program of the 2004-05 Emphasis Year on Stochastic Analysis and Partial Differential Equations at Northwestern University Many well known mathematicians attended the events and submitted their contributions for this volume Topics from stochastic analysis discussed in this volume include stochastic analysis of turbulence Markov processes microscopic lattice dynamics microscopic interacting particle systems and stochastic analysis on manifolds Topics from partial differential equations include kinetic equations hyperbolic conservation laws Navier Stokes equations and Hamilton Jacobi equations A variety of methods such as numerical analysis homogenization measure theoretical analysis entropy analysis weak convergence analysis Fourier analysis and Ito's calculus are further developed and applied All these topics are naturally interrelated and represent a cross section of the most significant recent advances and current trends and directions in stochastic analysis and partial differential equations This volume is suitable for researchers and graduate students interested in stochastic analysis partial differential equations and related analysis and applications

Limit Theorems for Stochastic Processes Jean Jacod, Albert Shiryaev, 2013-03-09 Initially the theory of convergence in law of stochastic processes was developed quite independently from the theory of martingales semimartingales and stochastic integrals Apart from a few exceptions essentially concerning diffusion processes it is only recently that the relation between the two theories has been thoroughly

studied The authors of this Grundlehren volume two of the international leaders in the field propose a systematic exposition of convergence in law for stochastic processes from the point of view of semimartingale theory with emphasis on results that are useful for mathematical theory and mathematical statistics This leads them to develop in detail some particularly useful parts of the general theory of stochastic processes such as martingale problems and absolute continuity or contiguity results The book contains an introduction to the theory of martingales and semimartingales random measures stochastic integrals Skorokhod topology etc as well as a large number of results which have never appeared in book form and some entirely new results The second edition contains some additions to the text and references Some parts are completely rewritten

Equivalent Circuit Model of Quantum Mechanics Masakazu Shoji, 2023-02-08 In the year of 2020 I published a book in psychology Self consciousness human brain as data processor In the book I proposed resolution of quantum mystery by human mind by providing a model Quantum mechanics has been developed by the basic philosophy that the theory's role is to identify the measurable quantum parameters and to provide the mathematical theory relating them The model's role is if that is available only secondary to rationalize the theory I challenged this basic philosophy in this book Quantum mechanics cannot be modeled by using any classical mechanics model but it can be modeled by using the equivalent circuit model of electronics I worked out the most basic details of this model and explained several mysterious quantum phenomena

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