

# Stochastic Mechanics and the Unification of Quantum Mechanics with Brownian Motion

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## Abstract

We unify Brownian motion and quantum mechanics in a single mathematical framework. In particular, we show that non-relativistic quantum mechanics of a single spinless particle on a flat space can be described by a Wiener process that is rotated in the complex plane. We then extend this theory to relativistic stochastic theories on manifolds using the framework of second order geometry. As a byproduct, our results show that a consistent path integral based formulation of a quantum theory on a Lorentzian (Riemannian) manifold requires an Itô deformation of the Poincaré (Galilean) symmetry, arising due to the coupling of the quadratic variation to the affine connection.

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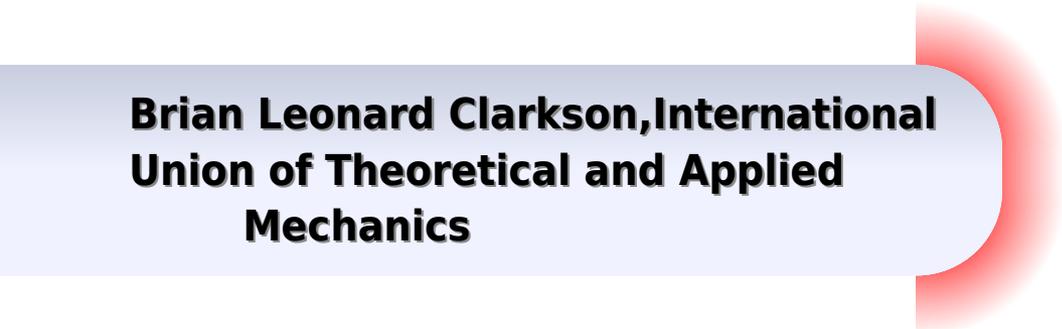
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# Stochastic Problems In Mechanics

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## **Stochastic Problems In Mechanics:**

**Stochastic Problems in Mechanics** Robert E. Bechhofer, 1982 Stochastic Problems in Mechanics S. T. Ariaratnam, Horst H. E. Leipholz, 1974 *Convegno Su "stochastic Problems in Mechanics"*, 1982 **Stochastic Problems in Mechanics**, 1974 **Stochastic Problems in Dynamics** Brian Leonard Clarkson, International Union of Theoretical and Applied Mechanics, 1977 Stochastic Problems in Mechanics Università e Politecnico di Torino. Seminario Matematico, 1982 *Stochastic problems in mechanics*, *STOCHASTIC PROBLEMS IN MECHANICS : PROCEEDINGS OF THE SYMPOSIUM ON STOCHASTIC PROBLEMS IN MECHANICS HELD AT THE UNIV. OF WATERLOO, SEPT. 24-26, 1973*, 1974 **Stochastic Problems in Mechanics**, 1974 **Stochastic Mechanics and Stochastic Processes** Aubrey Truman, Ian M. Davies, 2006-11-15 The main theme of the meeting was to illustrate the use of stochastic processes in the study of topological problems in quantum physics and statistical mechanics Much discussion of current problems was generated and there was a considerable amount of interaction between mathematicians and physicists The papers presented in the proceedings are essentially of a research nature but some Lewis Hudson are introductions or surveys New Perspectives In The Physics Of Mesoscopic Systems: Quantum-like Descriptions And Macroscopic Coherence Renato Fedele, Salvatore De Martino, Silvio De Siena, S De Nicola, Gennaro Miele, 1997-10-22 The very fast progress registered during the last few decades in physics has clearly shown the great necessity to give an interdisciplinary character to the scientific programs This has made the intersection between different branches of physics more and more important This volume contains theoretical and experimental results concerning the relationships among quantum like models macroscopic coherence and stochastic mechanics The wide range of topics covering particle accelerator physics plasma physics quantum optics superconductivities and mesoscopic gravitation is presented from a cross disciplinary point of view Uncertainty Assessment of Large Finite Element Systems Christian A. Schenk, Gerhart I. Schuëller, 2005-06-08 The treatment of uncertainties in the analysis of engineering structures remains one of the premium challenges in modern structural mechanics It is only in recent years that the developments in stochastic and deterministic computational mechanics began to be synchronized To foster these developments novel computational procedures for the uncertainty assessment of large finite element systems are presented in this monograph The stochastic input is modeled by the so called Karhunen Lo ve expansion which is formulated in this context both for scalar and vector stochastic processes as well as for random fields Particularly for strongly non linear structures and systems the direct Monte Carlo simulation technique has proven to be most advantageous as method of solution The capabilities of the developed procedures are demonstrated by showing some practical applications **Nonlinear Stochastic Systems in Physics and Mechanics** N. Bellomo, Riccardo Riganti, 1987 This book presents the conceptual line which goes from the observation of physical systems to their modeling and analysis by ordinary differential nonlinear stochastic equations First the problems of the mathematical modeling of physical systems

are developed These mathematical models are then classified in terms of ordinary differential stochastic equations from which both qualitative and quantitative results are developed Each one of the various subjects are methods dealt with ends with an application in mathematical physics or in nonlinear mechanics

**Nonlinear Dynamics and Stochastic Mechanics** Wolfgang Kliemann, S. Namachchivaya, 1995-04-18 Engineering systems have played a crucial role in stimulating many of the modern developments in nonlinear and stochastic dynamics After 20 years of rapid progress in these areas this book provides an overview of the current state of nonlinear modeling and analysis for mechanical and structural systems This volume is a coherent compendium written by leading experts from the United States Canada Western and Eastern Europe and Australia The 22 articles describe the background recent developments applications and future directions in bifurcation theory chaos perturbation methods stochastic stability stochastic flows random vibrations reliability disordered systems earthquake engineering and numerics The book gives readers a sophisticated toolbox that will allow them to tackle modeling problems in mechanical systems that use stochastic and nonlinear dynamics ideas An extensive bibliography and index ensure this volume will remain a reference standard for years to come

Stochastic Equations: Theory and Applications in Acoustics, Hydrodynamics, Magnetohydrodynamics, and Radiophysics, Volume 1 Valery I. Klyatskin, 2014-07-14 This monograph set presents a consistent and self contained framework of stochastic dynamic systems with maximal possible completeness Volume 1 presents the basic concepts exact results and asymptotic approximations of the theory of stochastic equations on the basis of the developed functional approach This approach offers a possibility of both obtaining exact solutions to stochastic problems for a number of models of fluctuating parameters and constructing various asymptotic buildings Ideas of statistical topography are used to discuss general issues of generating coherent structures from chaos with probability one i e almost in every individual realization of random parameters The general theory is illustrated with certain problems and applications of stochastic mathematical physics in various fields such as mechanics hydrodynamics magnetohydrodynamics acoustics optics and radiophysics

*Encyclopaedia of Mathematics* Michiel Hazewinkel, 2013-12-01 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977 1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivision has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science engineers and teachers of mathematics These

articles treat their material at a fairly general level and aim to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques

**Structural Safety and Reliability** Naruhito Shiraishi, Masanobu Shinozuka, Yi-Kwei Wen, 1998 *Archives of Mechanics*, 1976 Snapshot-Based Methods and Algorithms Peter Benner, et al., 2020-12-16 An increasing complexity of models used to predict real world systems leads to the need for algorithms to replace complex models with far simpler ones while preserving the accuracy of the predictions This two volume handbook covers methods as well as applications This second volume focuses on applications in engineering biomedical engineering computational physics and computer science

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