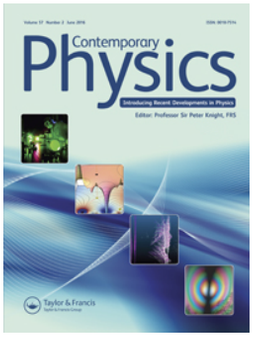

Taylor & Francis
Taylor & Francis Group

Contemporary Physics

ISSN: 0010-7514 (Print) 1366-5812 (Online) Journal homepage: http://www.tandfonline.com/loi/tcph20

An introduction to stochastic dynamics, by Jinqiao Duan

Miguel A.F. Sanjuán

To cite this article: Miguel A.F. Sanjuán (2016) An introduction to stochastic dynamics, by Jinqiao Duan, Contemporary Physics, 57:2, 266-267, DOI: 10.1080/00107514.2016.1156746

To link to this article: http://dx.doi.org/10.1080/00107514.2016.1156746

Published online: 16 Mar 2016.

A laboratory course in nanoscience and nanotechnology, by Dr Gerrard Eddy Jai Poinern, Boca Raton, London, New York, CRC Press, 2015, 230 pp., £35.99 (hardback), ISBN 978-1-4822-3103-8. Scope: manual, textbook. Level: general readership, undergraduate, advanced undergraduate, postgraduate, teacher, scientist, engineer.

There has been much talk about the excitement and importance of nanoscience and nanotechnology, and many courses now exist on these topics, but they are mostly descriptive or theoretical. Here is a book that gives clear laboratory instructions to perform practical experiments and it is excellent! It opens with very clear descriptions and definitions, with good references for further reading. It proceeds to give examples of how nanostructures occur in everyday life and influence phenomena such as wetting. There are good clear descriptions of some of the leading and important nanomaterials. This is followed by a concise description of the main methods for synthesis and characterisation of nanomaterials. Then comes a chapter that makes this book stand out: there is a very well-written chapter on laboratory safety and report writing. These topics are not the most exciting aspects of modern science judged by the groans and blank faces of students when these subjects are raised! However, here it is well presented and follows chapters that have built up the interest level to a considerable extent. This chapter is well placed coming before a series of very descriptive experiments in one chapter that can really stimulate the user of this book.

This chapter takes someone who could be completely new to chemistry through synthesis methods to make a variety of nanomaterials: gold nanoparticles, silver nanoparticles using 'green chemistry', zinc sulphide nanoparticles using a micelle route, carbon nanoparticles separated from candle soot, zinc oxide nanorods using a microwave method, bimetallic nanoparticles and polymeric nanoparticles. The details and illustrations are beautifully clear and my only concern is that there is a lack of chemistry discussion in each case, but I feel sure that any course organiser would attend to this deficit. There then follow further practical examples that explore applications, such as fingerprint analysis, release of a compound from a particle and superhydrophobicity and self-cleaning. Finally in this lengthy experimental chapter, there are practical instructions about scanning electron microscopy and atomic force microscopy. There is a final chapter on projects based on the previous comprehensive experimental set of instructions. This chapter might have been improved, but it is a useful guide to give ideas to a course organiser.

The overall presentation is very good, it has a high interest factor and is very well organised. There are one or two very small errors and bits of missing detail about temperatures in procedures, but this book will do much to stimulate a new generation of people to try and make practical nanomaterials!

Peter J. Dobson
The Queen's College, Oxford OX1 4AW, UK
peter.dobson@eng.ox.ac.uk

http://dx.doi.org/10.1080/00107514.2015.1133713

An introduction to stochastic dynamics, by Jinqiao Duan, New York, NY, Cambridge University Press, 2015, 310 pp., £41.99 (paperpack), ISBN 978-1-1074-2820-1. Scope: textbook. Level: postgraduate, early career researcher, researcher.

Physicists are very familiar with Brownian motion, the apparently random movement of a particle in a fluid due to collisions with the fluid molecules, through the work of Albert Einstein and Paul Langevin. It was precisely the latter who in 1908 first wrote a stochastic differential equation for the equations of motion of Brownian particles and obtained the diffusion constant. It constitutes an important chapter in the discipline of statistical mechanics. The study of dynamics as the science of motion in a broad sense is done with the study of dynamical systems. But dynamical systems, though deterministic, are affected by random influences, such as environmental external fluctuations, thermal fluctuations as random deviations out of equilibrium, which provide sources of noise in many physical and electronic systems, uncertainty in the initial conditions as well as uncertainty in the key parameters that govern their evolution. All these effects might have strong influences on the behaviour and the evolution of complex dynamical systems making it necessary to take into account all these effects in modelling complex dynamics in general.

Stochastic processes, stochastic calculus and stochastic differential equations provide the mathematical tools needed for that goal, what define the discipline of stochastic dynamics. There are many applications of this subject in applied sciences such as physics and engineering. Furthermore, there is a need to incorporate new knowledge for the learning of these methods, which includes simulations and algorithms, as well as the theoretical methods.

This book is based on lectures notes used by the author for a graduate course on stochastic dynamics, mainly oriented to mathematicians and with the participation of a small group of engineers and applied scientists. Part of the material corresponds to research carried out by the

author that corresponds to the final chapters related to most probable phase portraits and deterministic quantities for stochastic dynamics, random invariant manifolds and non-Gaussian Lévy processes. The first chapters include an introduction attempting to motivate the reader with a nice collection of examples taken from different disciplines such as physics, biology, geophysics, neurodynamics, population dynamics; a background in mathematical analysis and probability theory; and a mathematical model for white noise with an elementary introduction to stochastic differential equations.

The book contains also some discussions about simulations, though scarce. Every chapter ends with some interesting problems and hints and solutions to most of them appear at the end of the book, as a kind of appendix.

The author points out in a note the necessary prerequisites for a better reading of the book, including well-known monographs from dynamical systems and stochastic processes. There is a very complete and updated list of references at the end of the book, including as well some comments on further readings aimed for more advanced readers. The textbook is also illustrated with many simulations, most of them done with Matlab, aiming at a better understanding of the very abstract material discussed inside.

Needless to say, when a book is written, the author envisages in a certain way to whom the book is addressed. No doubt the author has written this book primarily for applied mathematicians. There are some concessions along the text to applications through some examples and descriptions in the introductions of the chapters. Nonetheless, the language and terminology used along with the included material make it clearly a mathematics book. This is, in my opinion, one of the main difficulties found to read the book. A few times even the author mentions that some stochastic differential equations are written differently in the engineering and applied sciences literature, and in particular in the physics literature. This constitutes a difficulty for a physicist familiar with the Langevin description of the stochastic differential equations.

It would have been very beneficial for physicists and applied scientists to find in the book more contents about simulations and algorithms, and more material about modelling techniques and applied stochastic methods. Unfortunately, this is not the case. The text is written in a very technical and certainly rigorous manner that would appeal to mathematicians and other readers with a very strong background in mathematical analysis and probability theory.

I believe that this book would be of interest primarily to mathematicians and to those mathematically oriented physicists with a strong background in analysis and probability, with a clear interest in a rigorous, mathematical and technical description of stochastic dynamics.

Miguel A. F. Sanjuán
Universidad Rey Juan Carlos
miguel.sanjuan@urjc.es

http://dx.doi.org/10.1080/00107514.2016.1156746

Henri Poincaré: a biography through the daily papers, by Jean-Marc Ginoux and Christian Gerini, World Scientific, 2014, 260 pp., £19-00 (hardback), ISBN: 978-981-4556-61-3. Scope: monograph. Level: postgraduate.

The subtitle of this biography of the distinguished scientist and philosopher Henri Poincaré is misleading. It was only in the late nineteenth century, when Poincaré was at the height of his powers, that he emerged into the daily papers. But more interesting, as an ongoing commentary within the book, is the reproduction of a considerable amount of correspondence between Poincaré and others. The book itself was published in French in 2012 to commemorate the centenary of Poincaré's death at the age of 58. The book is divided into four sections in a more or less chronological order.

The early years are covered in the first section where we learn that his father was a medical doctor and two contemporary cousins were distinguished in their own right: Raymond became President of France in the early twentieth century whilst Lucien was Inspector General for secondary education in physics. In high school he showed considerable potential in both literature and mathematics. He entered the *École Polytechnique* in 1873 and whilst there submitted his first original paper to the *Annals of Mathematics* which was published in 1874. From there he studied at the *École des Mines* and in parallel, at the Sorbonne, prepared for a bachelors degree and PhD. The latter was awarded in 1879, the year he was appointed as inspector of mines at Vesoul in eastern France. He spent eight months in this position. He was then seconded from this for his scientific career though he continued to belong to the *Corps des Mines* and indeed was appointed as Chief Engineer in 1893 and Inspector General in 1910.

In 1879 Poincaré was appointed lecturer in the Faculty of Sciences at the University of Caen, the beginning of a decade in which he shot to fame. Within a year he had submitted five papers to the *Academie des Sciences*, demonstrating a greater interest in research than teaching. Within two years, and by now married, he was appointed lecturer in the Faculty of Sciences at the Sorbonne. Early