

Perturbations of Positive Semigroups with Applications (Springer Monographs in Mathematics)

By Jacek Banasiak, Luisa Arlotti

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This book deals mainly with modelling systems that change with time. The evolution equations that it describes can be found in a number of application areas, such as kinetics, fragmentation theory and mathematical biology. This will be the first self-contained account of the area.

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Editorial Review

Review

From the reviews:

"Several books of different sorts have been devoted in recent years to semigroup theory applied to many types of problems. The book under review tries to answer some of the most important questions which arise in the above problems The references are very detailed the very accurate proofs of the theorems and the choices of the examples and applications make it quite readable. In my opinion, it is a very interesting and useful tool for both pure and applied mathematicians." (Silvia Totaro, Mathematical Reviews, Issue 2006 i)

"This book is a self-contained mathematical monograph devoted to the theory of semigroups of linear operators The book includes a systematic treatment of classical and recent results in this area as well as a comprehensive survey of the vast literature Each chapter contains a preliminary section with clear references to the bibliography and with technical remarks. ... Throughout the book, the style is clear and elegant. ... this book can be highly recommended to anybody who works in this area." (Adina Luminita Sasu, Zentralblatt MATH, Vol. 1097 (23), 2006)

"More precisely, as correctly described in the title, [BA] concentrates on the perturbation of positive semigroups and its applications to birth and death processes, fragmentation processes ... and to kinetic theory. ... Obviously [BA] should be in the hand of every researcher who is interested in any of these applications. It also seems to be the only book available that deals with relatively bounded positive perturbations of positive semigroups and with general questions of their stochasticity and honesty." (H. R. Thieme, SIAM Review, Vol. 49 (2), 2007)

From the Back Cover

Perturbations of Positive Semigroups with Applications is a self-contained introduction to semigroup theory with emphasis on positive semigroups on Banach lattices and perturbation techniques. The first part of the book, which should be regarded as an extended reference section, presents a survey of the results from functional analysis, the theory of positive operators and the theory of semigroups that are needed for the second, applied part of the book; worked examples are provided to help absorb the theoretical material. The second part then deals with the application of the developed theory to a variety of problems ranging from the classical birth-and-death type problems of population dynamics, through fragmentation models in both conservative and mass loss regimes, to kinetic models.

Features of particular interest include:

a survey of perturbation results for semigroups, beginning with the classical results and ending with more recent developments such as the Miyadera-Voigt perturbation theorem, Desch's results and an extension of the Kato theorem to Kantorovic-Banach spaces;

comprehensive analysis of the relations between the generator of a semigroup and the conservativeness of this semigroup, providing applicable techniques for characterization of the generator;

a full description of the dynamics of birth-and-death problems;

an analytical explanation of shattering and dust formation and of the existence of multiple solutions for fragmentation equations;

a detailed analysis of the linear Boltzmann equation with external field with both classical and inelastic scattering kernels, supplemented by an exhaustive treatment of boundary value problems for a streaming operator;

applications to the asymptotic analysis of kinetic equations.

The only prerequisites are a basic knowledge of functional analysis and measure theory. This is an essential one-stop reference for graduate and postgraduate students and researchers in applied analysis and mathematical physics who are interested in the application of functional analytic techniques to concrete problems arising in physics, biology and engineering.

Users Review

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