Introduction to Perturbation Theory in Quantum Mechanics By Francisco M. Fernandez (University of La Plata, Argentina)

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1 AUTHOR:

Artem E. Masunov

University of Central Florida

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of references is over 2500), serves as a very useful compendium of solid-phase synthetic procedures. The accompanying text is very informative, highlighting key theoretical aspects on each type of reaction while guiding the reader through the tables and figures.

The book starts with three introductory chapters on the general aspects of solid-phase organic chemistry: synthetic techniques and analytical tools, supports, and linkers, respectively. These chapters are supported by a wealth of figures and tables. Featuring almost 100 pages with more than 600 references, the chapter on linkers is particularly useful; it describes more than 50 different classes of linkers according to the functional group they attach. An almost equal number of tables is included to illustrate many examples of loaded resins with cleavage conditions and final products (including yield and purity). The next 13 chapters are organized in a highly subdivided fashion by class of supported product made, namely: organometallic compounds, hydrocarbons, alkyl and aryl halides, alcohols and ethers, sulfur compounds, organoselenium compounds, nitrogen compounds, phosphorus compounds, aldehydes and ketones, carboxylic acid derivatives, carbonic acid derivatives, heterocycles, and oligomeric compounds. Although organization by class of product is convenient and generally more preferable, at times it may be desirable to browse such a handbook by the category of reactions or substrates. Fortunately, the book ends with a very detailed index that helps overcome this small limitation. For example, although there is no section on the popular Suzuki cross-coupling reaction, the index refers to several relevant sections of the book. A search on Suzuki cross-coupling reactions as a means to make alkyl-substituted derivatives will lead the reader to a section in Chapter 5 ("Preparation of Hydrocarbons") entitled "Coupling Reactions with Boranes". For applications of the same reaction in the preparation of biphenyl compounds, yet another section of Chapter 5, "Preparation of Biaryls", must be consulted, although the latter blends other related processes, such as the Stille reaction.

Each section is filled with exhaustive tables showing the structures of starting and product resins, including the type of polymeric support, and accompanied with details on reaction conditions and the original literature references. The tables are not quite comprehensive, but additional relevant references are also compiled. Although readers will most likely consult the original sources before attempting a reaction, a small number of detailed procedures are provided for the most popular transformations.

Overall, this book is a very worthy addition, if not an essential one, to the library of all academic and industrial laboratories involved in solid-phase organic synthesis. It is the type of practical handbook that is bound to get worn out and exchange hands rapidly among labmates and colleagues.

Dennis G. Hall, *University of Alberta*

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Introduction to Perturbation Theory in Quantum Mechanics. By Francisco M. Fernandez (University of La Plata, Argentina). CRC Press LLC: Boca Raton, FL. 2001. xii + 272 pp. $99.95. ISBN 0-8493-1877-7.

Perturbation theory provides analytical, approximate solutions for the Schrödinger equation in many simple but nontrivial problems arising in theoretical chemistry. These analytical solutions are often useful for physical interpretation and suitable for numerical calculations. Unfortunately, the standard textbook formulas for high-order perturbation corrections are often unmanageable. This book shows several alternative strategies that are easily programmable. Since the use of computer algebra is mandatory for high perturbation orders, the Maple package is extensively used throughout the book to derive formulas and create tables. Texts for all Maple programs used in the book are collected in the supplement, so that the reader can reproduce and modify the formulas.

The book consists of nine chapters, which focus mainly on perturbation theory for bound stationary states. Chapter 1 lists the basic ideas and matrix equations of perturbation theory in number representation and illustrates their application on one-dimensional harmonic and anharmonic oscillators. Time-dependent perturbation theory is also outlined here. Chapter 2 deals with alternative coordinate representation, leading to inhomogeneous differential equations, and describes three widely used strategies to solve them (one of which was originally developed by the author). These strategies are also applied to the anharmonic oscillator problem and the Zeeman effect on the hydrogen atom. Chapter 3 describes three approaches that allow bypassing the explicit treatment of the wave function, and Chapter 4 applies the methods developed in the previous chapters to the treatment of the Stark and Zeeman effects on hydrogen atoms and molecular ions. Chapter 5 is dedicated to the Schrödinger equation with Dirichlet and periodic boundary conditions. Problems of this sort are useful in the theory of solids, molecular interactions, quantum wells, rotation spectra, etc. The convergence rate of the perturbation series is covered in Chapter 6, which also describes some methods for the summation of divergent series. Chapter 7 reviews the particular form of perturbation theory that is based on the expansion of the potential energy function in the Taylor series about a conveniently chosen coordinate point. In Chapter 8, the approaches developed for boundary states are applied to scattering states, and in Chapter 9, they are applied to problems in classical mechanics.

This book summarizes in detail a wide variety of techniques used in perturbation theory that were developed for particular problems. To make the methods easily comparable, they are applied to the same models. Some of these models have exact solutions, so that improvements in the perturbation series and their limitations become clear. The author intentionally avoids problems that require numerical computation and tries to keep the mathematics as simple as possible in order to concentrate the reader's attention on the ideas underlying each method. For those interested in probing the subject further, extensive bibliographic references are provided. Overall, the book offers an invaluable source of ideas for theoreticians applying perturbation methods to various problems in chemistry and physics; it can also be used for teaching undergraduate and graduate courses in this subject.

Artëm Masunov, *City University of New York*

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Modern Carbonyl Chemistry. Edited by Junzo Otera (Okayama University of Science). Wiley-VCH: Weinheim. 2000. xx + 614 pp. $169.95. ISBN 3-527-29871-1.

Modern synthetic organic chemistry relies heavily on the transformations associated with the carbonyl group. In *Modern Carbonyl Chemistry*, Otera's assembly of reviews by prominent scholars successfully presents a stimulating overview of the important concepts, recent developments, and classic reactions of carbonyl chemistry. One of the helpful strategies utilized in the text is a reliance on specific examples to illustrate key points as well as the historical developments and milestones achieved in each area. Additionally, the X-ray crystallographic data, transition-state structures, mechanisms, and conformational analyses that appear throughout render the concepts accessible to those less familiar with the material and provide a context for advanced readers wishing to extrapolate to new systems.

Several chapters that address the chemistry of Lewis acid−carbonyl complexes from theoretical and experimental perspectives establish a foundation for further discussions on carbonyl differentiation, recognition, chelation, and electrophilicity. The middle chapters, comprising over 40% of the book, highlight the venerable aldol and allylation reactions. This section offers a broad overview of well-established, practical modern methods and illustrates the application of these important reactions in the total synthesis of natural products. Additional chapters that concentrate on a spattering of more eclectic topics round out the material with discussions on acyllithiums, pinacol couplings, engineered catalysts, Michael-type additions, aqueous media, and radical reactions.

Brian L. Pagenkopf, *University of Texas at Austin*

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