the effort required for a complete analysis is frequently far greater than the results warrant or circumstances permit. On the other hand, it is probably also true that some spectroscopists may have been deterred by their unfamiliarity with the language of group theory and matrix algebra, in terms of which much of molecular vibration theory is expressed. Moreover, much of the necessary formalism has been available heretofore only in a few widely scattered journal articles. This book presents a thorough, consistent, and masterfully lucid exposition of the essential elements of the theory and will probably do much to encourage further interest in detailed vibrational analyses. The reader is led carefully and gradually through the main features of the theory and its methods, beginning with the simplest and proceeding to its most general and powerful formulation. Symmetry properties and application of group theory to molecular vibrations are gone into detail and with great clarity of presentation. The methods for setting up and solving secular equation are also lucidly explained, and finally applied to the benzene molecule as a specific example. The book will be welcomed both as a text and as a reference work.

Physicochemical Calculations. By E. A. Guggenheim and J. E. Prue. 491 pp. (North-Holland Publishing Co., Netherlands) Interscience Publishers, Inc., New York, 1955. $7.00. *Reviewed by George Zimmerman, Bryn Mawr College.*

This is a carefully prepared collection of 171 calculations based entirely on papers from the chemical and physical literature. Each calculation is worked out numerically in great detail, and is, on the whole, well-presented. The authors have succeeded quite well in making the selection as diverse and representative as possible and such that the book should be of considerable interest to physicists as well as chemists. Certainly in the last 30 years physical chemistry (judging its content by the average output of those in the field) has expanded greatly and now includes the field of chemical physics, as defined, say, by the *Journal of Chemical Physics*. In Guggenheim and Prue's book ⅓ to ½ of the problems could be classified safely as chemical physics, and only about ⅓ deal directly with chemical reactions. This distribution seems to be characteristic of present-day physical chemistry in spite of the fact that chemical reactions should probably still form the unifying basis of chemistry. In this book the selection of topics would, perhaps, better typify modern physical chemistry if the fields of experimental and theoretical molecular structure, radiation (including photo-) chemistry, and high polymers were better represented; also, considering that the field of nuclear physics *is* included (5 examples), it is inadequately treated.

The very laudable aim of the book is to provide instruction through practice in typical research calculations starting with raw experimental data—"problem working" in its most advanced form. In this country this book would be applicable both to undergraduate courses in physical chemistry and chemical physics and to first year graduate training in the same fields. It does not seem so well designed for self study, since the main value to students (and beginning instructors) certainly lies in carrying through such calculations by themselves and in their own ways, rather than in following the authors' often somewhat unnecessarily detailed algebra and arithmetic. There is also no attempt made to provide textbook references for the underlying theories; usually the formulas needed are used without comment.

I would be happier to see more emphasis on experimental uncertainties and errors, e.g., to see more use made of the theory of errors in treating data and results. It is gratifying to see the rather careful attention to units and dimensions and the frequent treatment of the same quantity (or system) from a number of alternative and often independent points of view. An excellent idea was to include a few cases where the results of a calculation clearly show that the underlying assumptions were inadequate!

On the whole, the authors are to be congratulated for what will no doubt prove a valuable and useful book.

Servomechanisms and Regulating System Design. Volume II. By Harold Chestnut and Robert W. Mayer. 384 pp. John Wiley and Sons, Inc., New York, 1955. $8.50. *Reviewed by T. Teichmann, Missile Systems Division, Lockheed Aircraft Corporation.*

This book is a sequel to a previous volume of the same name by the same authors, and is devoted in large part to describing the practical implementation of the basic principles set forth in this earlier work, and in fact in most introductory books on servomechanism design.

The book opens with a discussion of measurement techniques (open loop, closed loop, frequency and transient response, etc.) including a brief summary of the basic formulae of servo theory. The next chapter (II) deals with the influence of input characteristics on design, and treats the notion of equivalent sinusoidal inputs, and also noise errors and their effect on system optimization. In this connection a tracking loop is considered in some detail. The following chapters (III, IV, V, VI) concern respectively power requirements of control elements, networks for desired attenuation frequency characteristics (including an extensive table), amplifier design, and ac servomechanism operation. The final three chapters consider the application of nonlinear elements. Chapter VII describes the linearization of nonlinear elements for small departures from a fixed operating condition, while Chapter VIII discusses the large departure case. Particular attention is paid to problems of saturation backlash and hysteresis. Stability is discussed at length with reference to the linear picture, and many curves are presented, but there is only a very brief semi-qualitative description of the phase plane method. Chapter IX illustrates applications of nonlinear elements to servo design.