(the detectability of ^{13}C nuclei is about 63-fold less than that of ^{1}H nuclei at the same magnetic field). Both books review the methods that have been used to overcome these two rather serious limitations. In each case the authors have done an admirable job of avoiding overly sophisticated treatment of the field, and neophytes approaching the subject for the first time will find these works easy to read. The book by Levy and Nelson is more concise and is a slightly broader introduction to the subject in that it incorporates some of the recent relaxation research. It presents a brief outline of nuclear spin relaxation processes and a discussion of experimental methods for measuring such parameters. Stothers's book does not contain more than cursory statements concerning ^{13}C relaxation processes. This is somewhat understandable, for this book is pretty much limited to research published before the end of 1970 and relaxation data appeared primarily after that date. Up to 1971, Stothers has been so thorough in his review of CMR that future workers will now only rarely need to penetrate the original literature appearing before that date. As a compendium, which any serious worker using CMR techniques should have at his fingertips, the Stothers monograph is a valuable contribution. I expect that it will provide useful source material for many years to come for two reasons. First, the book contains an extensive tabulation of essentially all of the significant data collected in the few laboratories using CMR methods during the 1960's. Second, these data have been converted to the standard (tetramethylsilane) and conventions currently used by most workers for referencing spectra. This unification will do much to eliminate the confusion confronting workers using the early literature and to facilitate the development of routine CMR analytical techniques.

Both books are written in a clear and crisp style. They parallel one another in much of their organization. All the authors are recognized workers in the field, and their overview of the subject is balanced. Both books do a good job of covering the significant developments in the field, except as indicated above, and I have noted no serious omissions. CMR spectroscopy has developed into a powerful tool for structural identification in organic chemistry, the principal field for which these two books were written, and both monographs develop this theme. Parametric contributions to CMR chemical shifts are highly reproducible and faithfully represent a given structural feature. Organic chemists are provided with these substituent parameters in both books, and the methods of applying them are clearly treated in both. The discussion of spin-spin coupling involving the carbon-13 isotope is a bit perfunctory in both, but this probably reflects more the state of knowledge than any limitation on the part of the authors. Neither book provides more than an introductory treatment of the theoretical foundations of CMR, but then this limitation is mollified in both cases by the accurate application of concepts having their foundation in theory. Although Levy and Nelson treat briefly the importance of CMR in biological studies, both books would have been put to press before some of the recent results of biological importance were available. All serious CMR workers should have the Stothers book, and Levy and Nelson is recommended for those wishing a good but less detailed exposure to CMR.

DAVID M. GRANT
RONALD J. PUGMIRE
Department of Chemistry,
University of Utah,
Salt Lake City

Tidal Mathematics

The Analysis of Tides. GABRIEL GODIN. University of Toronto Press, Buffalo, N.Y., 1972. xxii, 264 pp., illus. $25.

I am glad to say that Godin has in this book reached his goal completely. In fact he covers all the subject defined by the book's title with no digressions to other fields.

The work is very well planned. It contains an introductory part covering the main topics pertaining to the genesis of the tidal phenomenon and a whole chapter presenting mathematical tools necessary to a good understanding of tidal analysis based on modern scientific concepts. This chapter will be very useful to those interested in any kind of time-series analysis.

All the classic methods of harmonic analysis based on linear combination of ordinates are treated as special applications of the Fourier transform theory. Thus the reader will have a grasp of all these methods and will find himself able to devise more suitable linear combinations to solve his own problem. However, Godin is a very wise adviser when by way of warning he states his very humorous and apt "Principle of Conservation of Difficulty" in connection with the linear combination of ordinates.

The accuracy of the results obtained through the harmonic analysis is studied in detail, including the problem of noise in the separation of constituents with close frequencies. A criterion is established by which to choose the constituents which can be obtained directly from the analysis. Such a criterion is based on the least-squares analysis, also treated in full, but it can be used as a guide whatever method is chosen.

The development of the harmonic analysis of tidal streams is quite good. The algebra is lightened by the use of a vectorial treatment in the complex plane. Here the author points out the need of analyzing the fragmentary records by the least-squares method, since lengthy continuous-stream records are difficult to obtain in practice.

A complete study is presented of the refined nodal factors and angles in terms of longitudes of lunar node and perigee, and a useful algorithm is given by which to compute them.

It may also be mentioned that the delicate problem of inference of harmonic constants is studied in detail. Some results of the technique used by the author here show that he has a large experience on the subject. He provides the reader with a complete understanding of what can be expected from that technique.

The problem of analysis in shallow waters is covered according to Doodson's and Horn's points of view. Their approaches are fully discussed in the text. A summary of the hydrodynamics necessary to understand the origin of the shallow water constituents precedes the theoretical developments.

The book contains a complete development of the Munk-Cartwright method of tidal prediction and analysis which will be easy to follow for the reader well acquainted with the subject covered in the chapter on basic mathematics. Some knowledge of spherical harmonics is necessary. Philosophical advantages of the method and a very sound discussion of the results are provided.

Finally an account is given of several very important points in practical tidal analysis, including the choice of a type of analysis and the error to be expected. Here the reader finds a summary of the Zetler-Cummings technique

to search for new harmonic constituents.

An addendum is included on prediction of tides as well as some very useful appendices, especially on complex numbers and matrix calculus.

I should like to finish this review by saying that Godin has presented an excellent and modern reference book on tidal analysis for those interested in improving their knowledge in this particular field of science.

A. S. FRANCO

Instituto Oceanográfico,
Universidade de São Paulo,
São Paulo, Brazil

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