

BOOK REVIEWS

Encyclopedia of Mathematics and its applications: Pade Approximants—Part I— Vol. 13-Basic Theory, Pages 325, Price \$ 32.50. **Part II—**Vol. 14-Extensions and applications, Pages 215, Price \$ 29.50. By. George A Baker Jr. and Peter Graves-Morris (Addison Wesley Publishing Co. Reading Massachusetts, 01867. U.S.A.)

It is not unusual for an area of Mathematics to undergo baptism in one century and get resurrected, after a period of indifference (relatively speaking), with renewed vigour in another! Many a time, this phenomenon—as in the history of group theory, for example—may be caused by factors outside mathematics, like the challenges posed by neighbouring areas like physics, and the advent of a new technology like the modern computer. Numerical mathematics (to cite, necessitated when there was no computer) is flourishing again *because* there is computer!

More specifically Pade' approximants presents a case of interest. After a relatively humble origin in the thesis of Pade' in 1892 (cf. attempts by Jacobi (1846), Frobenius (1881) and Anderson (1740) related to this), this field is 'alive and kicking' today, thanks to a vigorous pursuit of mathematicians and physicists alike! George Baker and Peter Graves Morris, widely recognised for their contributions to the theory and applications of Pade' approximants have provided us the benefit of their expertise through the two volumes on Pade Approximants, reviewed here.

The first part (Vol 13) is concerned with the basic theory-definition (chapter 1) methods of calculations (2), relationship to other numerical techniques like Aitkin's Δ^2 method, the ϵ - and η - convergence (3), kinship to continued fractions (one of its close ancestors!) Chapter 4; a very stimulating discussion on Stieltjes series and Polya series (5); and the ever-important questions concerning convergence (6). The first part thus provides formal approximation schemes for the various power series expansions (eg. the (L/M) of $\exp. (z)$ in terms of confluent hypergeometric functions: Besides, it provokes (eg. what about $\exp. (-1/x)$ or Euler's function or when the domain of convergence is an annulus) and illustrates the many subtle points thro' lucid expositions of many theorems and crisp exercises spread all thro' (even though rather thinly)!

The second part devoted to extensions and applications proceeds in the same jaunty spirit of the first volume. The extensions are multi pronged (eg-to *multi-point* model fitting, given function-values at various points, to *multi-variables*: to *matrix-coefficients* of a

power series expansion: towards Baker-Gammel, Pade-Fourier type generalisation etc.) all lucidly treated in chapter 1 Part II. The three chapters that follow sketch the linkage to applications of various sorts-integral equations and quantum mechanics (eg. scattering theory), chapter 2 II; numerical analysis (eg. the rational approximation connection, gaussian quadrature, Laplace transform Riccati equations etc.) 3, II and concluding with a very short discussion on the applications to quantum field theory spanning just fifteen pages (3, II).

The authors have admirably carried out their 'evangelic' task, convincingly demonstrating that the Pade-approximation has nothing to do with faith-healing! Just in case this message has not completely permeated thro' the text, the extensive bibliography will do the rest!

There is no doubt that these two volumes will inspire and convert many and continue to be used both as a teaching and reference aid for a long time.

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Proceedings of the Field Conference on N/Q Boundary, Indian, 1979 under I.G.C.P. Project 41: Published by the Geological Survey of India in 1982. Editors by M.V.A. Sastry, T.K. Kuriaw, A.K. Dutta, S. Biswas. Price: Rs. 143, £16.68, \$51.48.

The volume under review forms the proceedings of the conference, held under the joint auspices of the I.G.C.P. Project 41—"N/Q Boundary" and the I.N.Q.U.A., Subcommission on "Pliocene-Pleistocene Boundary", Geological Survey of India, Oil & Natural Gas Commission and the Wadia Institute of Himalayan Geology. The discussions were held at a Round Table Conference followed by an excursion through the Siwaliks of Himachal Pradesh. The publication contains an account of the general proceedings, excursion guide and full texts of the 37 papers read and discussed at the Conference.

The vexed problem of establishing criteria for fixing the N/Q boundary on a global basis, has been receiving much attention of the earth scientists. Studies in different parts of the world on various Pliocene-

Pleistocene sequences, occurring in continental, onshore and offshore settings, have led to the identification of local criteria based on stratigraphic, climatic and palaeontological aspects. More recently, paleomagnetic considerations have also been invoked in solving this problem. In this context, the contents of the various papers presented at the conference provide a good reading and reference material. Of course, as is always the case with all such gatherings, not all papers in the volume are restricted exclusively to the theme of the conference. Broadly, the papers can be divided to fall into following four categories.

- (1) Review papers highlighting the present status of N/Q boundary.
- (2) Papers dealing with N/Q boundary on the basis of palaeontology/sedimentology/magnetostratigraphy of various areas in different parts of the world.
- (3) Account of studies on Pliocene and Pleistocene deposits with vague references to the boundary problem.
- (4) Descriptive communications on vertebrate fossils, hominids and paleolithic cultures with little reference to the problem.

As such, only the papers belonging to the categories (1) and (2) are of direct relevance to the theme of the conference. The contributions of the remaining two categories, are useful only from the point of view of the data that they contain. Whether they should have been excluded, is a matter of opinion; personally I feel that they do not fully blend with the theme.

Of the two review articles on the status of N/Q boundary, the one by Kureshy gives a good and concise account of the historical development of the problem. Similarly, the review article by Sastry ideally summarises the existing information on N/Q boundary in India. The numerous papers dealing with the N/Q boundary in other parts of the globe, viz. Georgia, USSR (Gabunia & Vekua), Romania (Ghenea), Japan (Kamei & Otsuka), Italy (Nakagawa), Hungary (Ronai) and North America (Schultz), comprise notable contributions. These authors have attempted to precisely pinpoint the boundary on the basis of their studies in respective areas. The N/Q boundary is based in each case on different criteria, each one applicable to specific area, and not necessarily synchronous with one another. Though, in totality no clearcut picture of worldwide applicability emerges that could provide answer to the questions raised by the

I.N.Q.U.A. Subcommission on N/Q boundary, the various studies when taken together, provide a good insight into the problem, and appropriately show a direction for the future. Nakagawa's paper on the N/Q boundary and correlation of Vrica Section, according to me, is by far the best contribution. At Vrica in the southern environs of Crotona, Calabria the marine Plio-Pleistocene sediments, about 400 m thick, are well exposed along the Ionian coast and the valleys dissected into Milazzian terraces. Nakagawa has critically evaluated the biostratigraphic, magnetostratigraphic and radiometric aspects of the Vrica section and has strongly advocated to consider it as a potential boundary stratotype between the Pliocene and Pleistocene.

On the whole, the papers contributed by Indian geologists, barring a few, are disappointing. One expects precise and detailed information from an organisation like G.S.I., which has been putting considerable emphasis on Quaternary studies in recent years. P.R.L. studies on Karewas of Kashmir, are also inadequate and tell very little. Only two papers, according to me are of high standard. The one by O.N.G.C. (Ranga Rao, *et al.*) contains a wealth of data and very crisply highlights the problem of N/Q boundary in Siwaliks. Another good paper is that on Andaman-Nicobar Islands (Srinivasan), which gives a concise but lucid account of the micropalaeontology of the land-based sections of the Andaman-Nicobar late Cenozoic deepwater marine sequences. Srinivasan has contended that the first appearance of *Globorotalia trincatulinoides* associated with the extinction levels of *G. fistulosus*, *G. obliquus* and *Sphaeroidinellopsis* spp. could be considered to mark the N/Q boundary in the Andaman-Nicobar Islands.

Obviously, the N/Q boundary needs further studies from various angles and one cannot expect to get answers to all complexities in a conference or two. Viewed in this context, the present volume marks an important landmark, and does contain useful information for all future workers interested in N/Q boundary. I, however, hold a somewhat cynical view that the N/Q boundary in the sense that we are looking for, may not be existing at all! I wish I am proved wrong.

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