

Computational Methods for Partial Differential Equations. M. K. Jain, R. K. Jain and S. R. K. Iyengar. Wiley Eastern Ltd., 4835/24 Ansari Road, Darya Ganj, New Delhi 110 002, 1994. pp. 244. Price: Rs 80.

The rapid development of high-speed computational facilities has been accompanied by a very substantial growth of numerical methods. The literature on computational methods for solving partial differential equations has grown very much in the last two decades. It is widely scattered and differs greatly in viewpoint. This book describes the numerical methods for partial differential equations in simple terms in a manner that can be understood and used by students, thus facilitating the learning of the basic schemes. It provides the student the necessary intuitive foundation to start with this subject. It can serve as an introduction to more specialized study in specific applications.

This book has been written in a style similar to G. D. Smith's book on *Numerical Solution of Partial Differential Equations*, but here more numerical schemes have been discussed. It has four major chapters. The first chapter gives a brief introduction to the difference methods and the concepts of stability, consistency and convergence. Chapters 2 and 3 discuss the computational methods for solving parabolic and hyperbolic differential equations. Finite difference methods remain important in these two chapters. Questions on stability and convergence of various schemes are covered as a necessary complement to the study of the methods. The techniques for solving conservation laws have been just mentioned. A more detailed discussion of these would benefit a large number of readers as they form an important class of hyperbolic problems. Variational methods have been outlined in Chapter 4 under the methods for elliptic partial differential equations. Special topics discussed here include the finite elements and multigrid methods.

The authors have attempted to explain the various schemes and their stability criteria through easily understandable problems. The exercises at the end of each chapter would further facilitate the understanding of the schemes. Answers to these exercises are also provided as an added advantage.

Since the main emphasis of this book is on problem-solving, it does not encourage the reader to think deeply. A mention of references would have helped the interested reader in further studies from original publications.

On the whole, the authors have succeeded in conveying the importance of numerical methods for solving partial differential equations. Since 'numerical methods for partial differential equations' does not form a part of the curriculum in most of the Indian Universities, this book will be of great help to applied mathematicians and engineering students interested in this field.

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The Structure of Music in Raga and Western Systems. R. Ramanna, Bharatiya Vidya Bhavan, Kulapati Munshi Marg, Bombay 400 007. 1993. Price Rs. 400. 196 pp.

The recent publication by Bharatiya Vidya Bhavan of the 'Short Work' on the *Structure of Music in Raga and Western Systems* by Dr R. Ramanna, the well-known physicist, is a welcome addition to musicological literature, particularly since it has emanated from one who is a scientist equally familiar with both the systems. Indeed, he is a reputed pianist and this has stood him in good stead in producing this work. It aims essentially at the Western audience and tries to project South Indian Music via the Western staff notation.

There are eight chapters in all. After explaining the *Melakarta* system (the generic scale system of Carnatic music) in Chapter 1, and the basic *Tala* system in Chapter 2, the model shift of *Raga* generation is discussed in Chapter 3. *Janya Ragas* are briefly dealt with in Chapter 4, while Chapter 5 discusses the harmonic elements in the *Raga* system – this is rather important in view of the title of the work – and its applications are dealt with in Chapter 6. Chapters 7 and 8 deal, respectively, with form in Carnatic music and the aesthetics of the *Raga* system.

A few preliminary remarks here will be in order. There have been some attempts in the past at presenting our music in the Western staff notation. As the author observes, the earliest known work seems to be that of Chinnaswamy Mudaliar almost 100 years ago (his monumental service to Carnatic music may be recalled: it was also he who persuaded Subbarama Dikshitar to place on written record the works of the great composer Muthuswamy Dikshitar, which otherwise might have been lost). Later we find such attempts by H. A. Popley (*The Music of India*, YMCA Publications, 4th edition, 1971) and by P. Sambamurthy (*Indian Melodies in Staff Notation*, Indian Music Publishing House) and more recently by Walter Kaufmann in his *The Ragas of South India*, (Oxford & IBH, 1976) covering over 2000 ragas. The current work nevertheless should prove of value coming as it does from an expert pianist who knows Western music well and it is more systematic and comprehensive.

In the introductory section, the author states his objective clearly: "The purpose of this work is to bring to the attention of both Indian and foreign musicologists the main structure of the *Raga* system, both in staff notation as well as in *Devanagari*, with the hope that it will be a useful introduction to a wide range of musicians." He has put in a laudable effort and has achieved his goal to a large extent with some minor reservation. This stems mainly from the fact that currently available musicological tools are still not fully adequate to convey the richness and complexity of the *Raga* system as practised in India. There is indeed a great need for deep research and scientific analysis before anyone can really hope to achieve this goal. But within these constraints the author has produced a good introductory exposition which is to be heartily welcomed.

Coming to some details, the assumption of equitempered scale to illustrate our music to the Western audience is dictated more by practicability on the piano and other Western instruments. The equitempered scale caters to harmony. It certainly does not reflect the more central theme of Indian Music, which is based on just intonation. It is debatable whether the approximations implied in the assumption are fully justified or not. Most traditionalists will not accept that South Indian Carnatic Music (at least that prac-

tice in the last few centuries) is based on equitempered scale.

That quarter tones, microtones well known in Western music, are adequate or can be pressed into service in explaining non-equitempered scales or other features of Indian Music will take the essence out of our system. The result is that the richness of the full 22-*Sruti* system so vital to melody fades into mere 12 *Svarasthanas* which are regimented still further into equal intervals to suit Western harmony concepts. As is well known, scale derivation in our system is fundamentally based on *Samvadi* (consonance) relation and has been tied up with the fretted *Veena*. Even the formulation of the 72 *Melakarta* scheme of Venkatamakhi is anchored on this theme solidly. It would, therefore, seem appropriate that the present work is to be considered as one essentially involving a major approximation and not one capable of projecting in its entirety our classical musical systems in the Western staff notation.

Discussions of both *Melakarta Raga* in Chapter 1 and *Janya Ragas* in Chapter 4 have to be reckoned with the above observation in background. It is perhaps pertinent to point out that (even though Venkatamakhi might have proclaimed that even Brahma cannot challenge his scheme) an extension of his argument can lead to a possible more accommodative system such as the Venkatamakhi Krishnachandra scheme of 90 *Melartas*. (see, for example, *Mathematical & Computer Analysis of Raga Structure, Sritis & Murchkanas*, ed. R. Srinivasan, Sangeet Natak Publication, 1981, p. 123 and 157, hereafter referred to as SN volume).

The use by the author of terms *Melakarta* scales and *Melakarta Ragas* interchangeably is rather unfortunate, particularly in the absence of a proper clear distinction in the discussions. Even the Venkatamakhi's formulation gives only the scalar material on which a *Raga* is based and the two are not the same: a point not fully appreciated by many. The former is only a skeletal framework whereas the latter based on the former is extraordinarily rich in terms of addition of 'flesh, and blood' to bestow the personality to the *Raga*. The flesh and blood may be taken to be the subtle nuances such as the *Gamakas*, *Sancharas* (rules of phrasing *Svaras*) and the like. These are from a theoretical standpoint, 'higher-order' effects.

The modal shift operation (known to the Westerners through Greek music) has been treated visually in this volume rather well through an elegant circular projection and this certainly enables an easy understanding of the process involved. In the south Indian literature this is known and documented (Prof. Sambamurthy, *South Indian Music Book*, vol. 5, The Indian Music Publishing House, 2nd edition, 1963) and has recently been dealt with systematically and thoroughly availing modern computers and several corrections made in the earlier work (SN volume, p. 103 and 157). When it comes to *Janya Ragas*, although the summary in Table 4a projects the data aptly, a doubt is likely to arise in the minds of beginners (particularly, the Western audience) as to how the problem of fixing the *Janaka Raga* is handled for a given *Janya Raga*. This arises from the fact that we only have the scalar material defined and when it is a 6-note (*shadava*) or 5-note (*audava*) scale, one can fit it equally into more than one generic scale depending upon which note(s) are absent. That the fixation is done in such cases based on other criteria (mostly second-order effects) could have been explained. It is with this background the contents of Chapter 4 on *Janya Ragas* have to be viewed, including discussion pertaining to Table 4b on *Murchhana Karaka Janya Ragas*.

While discussing the harmonic elements in the *Raga* system (Chapter 5), Dr Ramanna comes out with his own ideas on harmonization in melody music as practised in India. In fact, he counters the earlier opinion of Chinna-swamy Mudaliar that 'European harmony mars all the beauty and intrinsic grace of oriental melody'. His suggestion is to use certain sets of intervals which are common to or are implied on the very nature of the *Murchhana* system discussed earlier.

He cites the examples of *Todi*, *Kalyani*, *Harikamboji*, *Kharaharapriya*, *Sankarabharanam* and *Natabhairavi*, which are all *Murchhana*-related and have common interval 212212 figuring in their relation (2 = full tone, 1 = semitone), which leads him to suggest 'triads' appropriate for a given *Raga*.

This suggestion, although logical and in conformity with Western concepts, raises a very delicate poser to Indian musicians and musicologists. It is true that *Murchhanas* are practised even by renowned musicians both on vocal and

instrumental modes. But the moment a switch-over is indicated from one *Raga* to the other, the 'second-order effect' will be seen to be different in bringing out the *Raga* personality as otherwise the purely scalar material alone will not be able to bring out the features. It is again in this context the pivotal role of tonic (*Adara Shadja*) in perceiving the relational intervals that bring out the *Raga* needs emphasis: something which is anchoring our melody music. The intrinsic capacity of the brain to interpret the same whether or not the drone is on or off implies that perception of *Raga* melody is a highly conditioned affair. From such a point of view although his suggestion is practicable conceptually, it becomes questionable of it is in tune with *raga* system as developed and nurtured in Indian music. After all such triads are just combinations of 'scalar material' and as already mentioned earlier scalar material and full *raga* are never the same.

In Chapter 6 he gives application of the theory of using triads to examples of *Purandaradasa Gita* in *Malahari* and a few more cases. Chapters 7 and 8 neatly summarize to the Western audience the 'form' and 'aesthetics' of our melody music. The discussion on our *Tala* system in a simplified version (35-*tala*) in Chapter 2 is quite satisfying.

Almost all the chapters contain illustration of *Ragas* and composition in the staff notation, including, as indicated earlier, the possible use of triads for harmonization. Musical notation and definitions are briefly covered in Appendix 1 (which are for the Western readers) and a glossary (Carnatic music) also finds place at the end.

The get-up of the volume is very good. There are a few printing errors which could have been avoided by careful editing: For example, inconsistent but repeated alternate use of *Melakarta* and *Melakarta* in bold letters and mis-spelling of *Raga* names at several places.

The book is an important addition to the musical literature of India and a *must* for all musicologists and musical libraries in India and abroad.

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