
Wavelet Analysis: The Scalable Structure of Information. Howard L. Resnikoff and Raymond O. Wells Jr. Springer-Verlag, India Liaison Office, 906-907 Akash Deep Building, Barakhamba Road, New Delhi 110 001. 2000. 435 pp. Price: Rs 440.

As a subject, wavelet analysis is both old and new! Some of the ideas central to wavelet analysis have been known for over a century to researchers in the areas of mathematics, physics and electrical engineering. What makes the field particularly remarkable is the manner in which these ideas have been viewed from a renewed angle, generating new lemmas, theorems and applications! In that sense, the age of this field would now be about twelve years.

There are now several authors and books pertaining to wavelets; and the number of good papers on the subject would, very likely, cross the ten-thousand mark with ease. Even so, there are some things that make this book under review, special. The first is the way in which the authors introduce the idea of wavelets: as a 'positional notation' for functions. I thought this idea was rather elegant and I have hardly seen any other introduction to the subject which brings out the fundamentality of wavelets in the context of functional analysis with such a powerful analogy. In fact, that is exactly what wavelets are, when one comes to think about it. They help approximate a function at various levels of accuracy. What is more important, they help identify the specific 'features' of the function that are pertinent to each given resolution in a neatly decoupled manner.

The book is a beautiful example of a blend between the mathematician's passion for rigour and conceptual thoroughness and the engineer's desire to see mathematics fruition into a broad spectrum of applications. The authors divide the book into essentially four sections. In the first one, they make a strong case for wavelets and explain how the nature of information is often inherently multiresolution in character. The fundamental ideas pertinent to the subject have been brought out very effectively with practical analogues, like the notation of music. This is followed by a section which deals with the mathematical theory of wavelets in detail.

The treatment of mathematical details commences appropriately with wavelet matrices rather than continuous time functions. There is definitely an emphasis in the book on being able to realize the concept of wavelets through implementable structures. A nice marriage between the mathematical idealizations of linear functional spaces and realizable discrete structures. Both one-dimensional and higher dimensional wavelet systems have been dealt with in the book. This makes it attractive to a wider spectrum of researchers. For example, researchers in image processing and computer vision will find the higher-dimensional systems treated to be of importance. On the other hand, researchers in audio or channel coding applications would probably look at the one-dimensional systems in greater detail.

One appreciates the authors' joint treatment of the problem of wavelet approximation and that of formulating concrete algorithms for solving mathematical problems through successive approximation or iterative refinement. Connection coefficients are an important tool in translating standard differential equations into a wavelet framework. The concept has been brought out lucidly in the tenth chapter. Wavelets have an important role to play in the solution of partial differential equations and in arriving at solutions of such equations, elegantly, through proper reformulation. In fact, the idea of multigrid approximation and solution is particularly powerful in this context. This is treated very nicely with an example by the authors.

There have been two parallel streams of development in the subject of wavelet analysis – the stream of mathematical tools and techniques and the stream where these find various roles to play in the world of engineering applications. In the engineering literature, the most 'talked about' application of wavelets has been data compression. Image compression with wavelets has been quite effective. For example, fingerprint image compression with wavelets has been a particularly successful arena and there is actually a discussion of the technique in the related standards. It is nice to see that the authors review transform image compression in general and then provide explanations of what makes wavelet-based compression specifically useful. For example, embedded coding has been

dealt with in the thirteenth chapter on applications.

Wavelet applications are not, however, confined to compression. Denoising and data transmission are important newer areas of application. The discussion on these in the fourteenth chapter makes the book particularly valuable to an electrical engineer. There are not too many books that talk about this facet of wavelet analysis. It is even more rare to find a discussion on wavelet-based channel coding, which is present in this chapter. One wonders why the discussion on test results seems a bit too concise. It could be because the results involve some patented information which may not be too easy to disclose. Even so, the fourth and last section on applications is quite broad in its spectrum and leaves the reader contented in the thought that a subject so mathematically complete is also equally applicable in diverse practical scenarios.

All-in-all, a valuable book indeed for researchers and practising professionals in numerous areas, including approximation theory and practice, data communication, computers and mathematics. To the person interested in wavelets, a specially valuable book – for its broad and thorough treatment of many diverse aspects of the subject.

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The Web of Knowledge: A Festschrift in Honor of Eugene Garfield. Blaise Cronin and Helen Barsky Atkins (eds). ASIS Monograph Series. Information Today Inc., 143 Old Marlton Pike, Medford, New Jersey 08055, USA. 2000. 565 pp (hard bound). Price: US \$ 49.50.

In any field of activity and study, it is seen that once in a while a person emerges to give an entirely new concept, dimension and colour to that field, which leads to new fields of study/research emerging out of the new ideas. Such a

thing happened undoubtedly to the field of information science when Eugene Garfield entered this sphere nearly five decades ago.

Garfield, the well-known and familiar name among librarians, information personnel, people working in the fields of scientometrics, bibliometrics and a large number of scientists, was honoured at a function held at the Institute for Scientific Information, when an advance copy of this book under review was presented to him on his seventy-fifth birthday in September 2000. Starting with his now famous information tool, the *Science Citation Index (SCI)*, he went on to develop other tools and information products like the *Current Contents*, *Citation Indexes* for other fields (arts, humanities and social sciences), which brought together subjects by linking them through the citations and showed the interconnectivity between different subjects. He founded the now well-known information publisher, Institute for Scientific Information (ISI) at Philadelphia, which brings out products not only in the field of science but also in technology, business and arts. He is the founder editor of the science newspaper, *The Scientists*, from ISI. It was not an easy and smooth path for Garfield to get his ideas accepted by the scientific community. He had to persistently argue and write extensively in scientific journals and in his weekly column in *Current Contents*, the various aspects of the tools he had provided to the community and their ramifications. Due to those efforts, today the field of 'Citations' has gained much importance not only among information personnel, but also among scientists, administrators and planners. It has become one of the factors to be considered for any reward/recognition to researchers.

This book edited by Blaise Cronin, the Dean of Library and Information Science at Indiana University and Helen Barsky Atkins of Institute for Scientific Information, chronicles Garfield's interest in organizing information, developing citation indexing and *Current Contents*, application of Garfield's tools in interlinking subjects. There are twenty-six articles (for some reason the editors have labelled every article as a chapter) contributed by well-known scholars from Europe, India and USA belonging to diverse fields like economics, library and information science, sociology, science

and scientometrics. These articles are grouped under five thematic topics and each one of them presents a comprehensive picture of that topic, giving new developments. It has not been possible in this review to comment on every article included, but an attempt has been made to cover the various themes and mention a few articles from each theme.

The first chapter (reviewer's terminology) covering 'Historical perspectives' gives an insight into the life and work of Garfield, starting of *SCI* and about assessment of ISI. The Nobel laureate in Medicine, Joshua Lederberg, who advised and supported Garfield in his endeavour to develop a citation index for science, takes one through the genesis of *SCI* and has reproduced for the benefit of those who have missed the seminal article of Garfield 'Citation Index for Science' in *Science* (1955, 122, 108). Also reproduced are some interesting items of correspondence between Lederberg and Garfield.

The end point of any research is obviously the publication of the findings (excepting in those cases where the work pertains to defence projects and company research) in journals. As the medium enabling dissemination of research work, a journal helps in accretion of knowledge and promotes development of any field. Since the publication of the first scientific journal in English in 1665 (*The Philosophical Transactions of the Royal Society*), the growth of journals has been phenomenal (both in terms of the number of journals in different fields and their size). In fact, it has reached a stage where one has to carefully choose the journals to keep pace with the information explosion. To combat this explosion, new information tools such as databases have been developed. With the growth of the literature, new fields of study like bibliometrics and scientometrics have emerged and papers published in these fields form a substantive part of the information science literature. In the chapter on 'scientific literature', articles have addressed the above theme. In his article on 'Growth of journal literature: A historical perspective', Jack Meadows gives an overview of some studies carried out on this aspect. The work of Derek de Solla Price, the author of the well-known book *Little Science, Big Science*, is also discussed in this chapter. While the journal is used as a medium for communica-

tion or more aptly recording research findings for priority and posterity, is it also the one used by scientists to keep abreast of the recent developments in the field? The answer is perhaps 'no', especially in today's context. Researchers depend more on other avenues – conferences, discussions among colleagues, close networks and invisible colleges. Stephen Cole has discussed this issue in detail in his article 'Role of journals in the growth of scientific knowledge'.

Science (especially experimental) is no longer carried out as an individual effort and has become one of team research, with collaborators from different institutions from within the country as well as across the continents coming together. Like many other activities, it has become global in nature. Three articles in the chapter on 'International issues' have discussed the issues emerging out of collaboration and networks in science. Subaiah Arunachalam, in a comparative study of the collaboration between different countries, has presented a detailed finding about the collaboration between scientists of India, China, Israel and Japan and those of other countries. From his study it is interesting to note that papers of scientists collaborating from developing countries with those from developed countries are published mostly in journals of high impact value. And perhaps because of the low impact factor of most of the Indian journals, such articles are not published in them. (The highest impact factor for any Indian journal currently is 0.625 for *Journal of Astrophysics and Astronomy* published by Indian Academy of Sciences, Bangalore). Time and again, the issue of coverage of journals in *SCI* (especially journals from developing countries) has been questioned. Obviously, from more than 50,000 S & T journals (a rough estimate from recent edition of *Ulrich's International Periodical Directory*), ISI has to have its own criteria for inclusion/exclusion of journals in *SCI*. Tibor Braun *et al.* have addressed this question from a macro level in their article 'How balanced is the *Science Citation Index*'.

The relationship between science and society has been studied for a long time by sociologists, economists and historians. Robert Merton opened up this field in the late fifties at Columbia University. Citation tools were used for studying

different aspects of a subject, especially to measure the impact and quality of publications. Even during the beginning of such studies and to date, there have been heated discussions regarding the efficacy of using citations to judge the contributions of both well-known personalities in the field and others, not so well-known. The other measure, 'impact factor', widely used for assessing the quality of journals, is always looked with certain suspicions. The reason for this situation is certainly not due to the limitations and shortcomings of tools such as *Citation Indexes* or *Journal Citation Reports*, but more due to the wrong interpretations drawn by those undertaking such studies. For it has been very clearly indicated by those who created and developed these tools as to how they should be used and what sort of comparisons should not be attempted. Many studies are published (including in *Current Science*) wherein comparisons are made of impact factor of journals belonging to different subjects (mathematics with biochemistry) and of journals of different nature (review journals with research journals), leading to erroneous conclusions. In the chapter on 'Evaluative bibliometrics' these aspects as well as patents citation counts, refinements to impact factors and use of scientometrics by economists in different

studies have been very-well presented in eight articles. It would be apt to quote here from the article of Jonathan Cole in this chapter about citation counts. He says and very rightly 'There has been a tendency over the years to reify the meaning of citations. Citation counts are not measures of quality in and of themselves. When the measure is used as an indicator of the quality of an individual's work without examining the "meaning" of the citations to the work, particularly the type of citations and the characteristics of those who cite the work, the probability increases of drawing inappropriate inferences about the impact or quality that an individual's scholarly and scientific work has had on his specialty or field'. This caution should be an eye-opener for all those rushing to publish articles based on their bibliometric studies, which are more often mere citation counts.

In the present era, with communication on the web becoming more and more common, a new field, 'Webometrics', has come into being. In this, the principle of citation analysis is very much made use of and Garfield's early ideas of relating different subjects through citations have taken roots. The fact that references at the end of an article indicate the trust among researchers about each other's

work, the significance of citations and the use of citation analysis in recent projects such as 'Clever Project' in USA, have been presented in the last chapter 'Social network analysis'.

Almost all the articles have included useful tables and figures, references, and end notes which have certainly enhanced the quality and utility of the papers. In spite of the reservations among some scientists about the field of bibliometrics and scientometrics (which I presume is more for the ill use and wrong interpretations drawn by authors based on their bibliometric/scientometric studies, than for the merits of the tools themselves), this publication is undoubtedly one of its class and is a true tribute to the master. It is highly recommended not only for those who have worked in the field for a long time, but also for all the new entrants to the field of library and information science as well as those academicians who doubt the validity of quantitative analysis.

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