

BOOK REVIEWS

CD REVIEW

A. K. Krishnaswami Ayyangar's Works on the History of Indian Mathematics.

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It should be an interesting problem for a socio-psychologist to analyse the effects on the members of a society brought upon by the birth of a genius among them. Such a typical instance was the birth of Srinivasa Ramanujan in the Tamil country. Whatever be the other effects, it certainly led to an increased awareness and appreciation of the rich mathematical heritage of India and a renewal of interest in the study of mathematics. This renaissance in Tamil Nadu showed itself in the coming up of a number of gifted teachers, well versed not only in mathematics, but also in the mathematical legacy of the country. A. A. Krishnaswami Ayyangar was prominent among them.

A. A. Krishnaswami Ayyangar (often cited in mathematical references as AAK) was born in a traditional Vaishnavite family in the village Attipattu, Chingleput district, Tamil Nadu on 1 December 1892. He had two brothers and two sisters.

After completing his Masters' degree in mathematics from Pachaippas College, Chennai, and after teaching for a few years at the same institution, he moved over to Mysore to join the Mysore Educational Service and worked at Maharaja's College, where he taught till his retirement in 1947. He also worked for some time as a Reader in the Department of Statistics, Andhra University at Waltair. Apart from his teaching, he did research in some areas like geometry, history of ancient Indian mathematics, and statistics and published several papers.

Krishnaswami Ayyangar married Seshammal and they had four sons and two daughters, who have distinguished themselves in their chosen walks of life. Krishnaswami Ayyangar passed away in June 1953.

The CD under review is a tribute to Krishnaswami Ayyangar, offered by his family. Along with a brief explanation of its genesis, the CD contains fourteen arti-

cles by Krishnaswami Ayyangar, mainly devoted to the 'History of ancient Indian mathematics', published at various times. We shall discuss them in some detail.

The article entitled 'Some glimpses of ancient Hindu mathematics', published in *Math. Stud.* in 1933 gives a scholarly account of the evolution of Indian mathematics from the times of Vedanga Jyotisha to the mathematics of Bhaskara. In his 'The Hindu Arabic numerals' (*Q. J. Mythic Soc.*, 1926), the author presents a remarkably coherent account of the numeral system in India and the decimal notation, making plausible guesses about the manner in which they spread to Europe. In the process, he refutes the views held by some of the Western scholars like G. R. Kaye, whose aim was to belittle the Indian contributions in general. There is an excellent article in Tamil on the 'History of ancient Hindu mathematics', which the author had written for the first edition of the Tamil encyclopaedia. Besides being comprehensive and readable, it is quite up to date and ends with a mention of the work of C. T. Rajagopal and his collaborators on the contributions of the Kerala School of Mathematics.

Krishnaswami Ayyangar's articles on 'Aryabhata' (*Q. J. Mythic Soc.*, 1926) and on the 'Bakshali manuscript' (*Math. Stud.*, 1939) both exhibit the author's knowledge of and feeling for ancient Indian contributions to mathematics. For example, his article on Aryabhata not only covers quite extensively Aryabhata's work on astronomy, it equally deals with the mathematics of Aryabhatia, including a precise account of the Kuttaka method of solving linear indeterminate equations. Krishnaswami Ayyangar puts up a critical defence against the arbitrary dating and haphazard assessment by Kaye of the Bakshali manuscript.

There are six articles of Krishnaswami Ayyangar included in the CD, which are related to the work of Bhaskara. The short note entitled 'The earliest solution of the biquadratic' (*Curr. Sci.*, 1938, 7) discusses the work of Bhaskara on a specific fourth degree polynomial equation, which is solved by adding suitable quadratic polynomials on both sides of the equation and completing squares. This involves in general the solution of a cubic (in the special case considered by Bhaskara, one of its roots is easily guessed). This is the same as the method used by the European mathematicians centuries later. In his article entitled 'Remarks on Bhaskara's approximation to the sine of an angle' (*Math. Stud.*, 1950)

Krishnaswami Ayyangar discusses an approximation to $\sin(\pi/n)$ by a certain rational function of n and remarks that the same approximation is arrived at by the astronomer Ganesa of the 16th century. The paper 'Bhaskara and Samclishta Kuttaka' discusses the solution by Bhaskara of simultaneous linear indeterminate equations of several unknowns, which was found in two palm-leaf manuscripts of Bhaskara's *Lilavati* and raises the question of the genuineness of Bhaskara's authorship of this.

In a beautiful paper (*JIMS*, 1929–30, 19) entitled 'New light on Bhaskara's Cakravala method of solving indeterminate equations of second degree in two variables', Krishnaswami Ayyangar elucidates the famous cyclic method for solving indeterminate quadratic equations of the type $x^2 - Ny^2 = 1$, by reducing the problem to solving equations of the form $x^2 - Ny^2 = +2$ or -2 , $x^2 - Ny^2 = +4$ or -4 , as expounded by Bhaskara. (It should be noted that K. S. Shukla has shown in 1954 that the cyclic method was discovered much earlier.) In his papers entitled 'The new continued fraction' (*Curr. Sci.*, 1937–38, 6) and 'Theory of nearest square continued fraction' (*J. Mysore Univ.*, 1940), Krishnaswami Ayyangar deals with the Indian method of half regular continued fractions (which is somewhat different from the type of continued fractions suggested by Minnegorod) and shows that this is a natural sequel to Bhaskara's cyclic method. On the other hand, Lagrange used the method of simple continued fractions for finding the solutions of the equation $x^2 - Ny^2 = 1$, a method which is different from that of Bhaskara.

There are also a couple of articles of Krishnaswami Ayyangar in the CD dealing with Indian almanacs and a short note by him containing new proofs of classical theorems of Apollonius and Brahmagupta.

In spite of the fact that these articles were written several years ago, they deal with issues which are of current relevance and make interesting reading. One is impressed by the scholarship of the author, his knowledge of the subject as well as of Sanskrit. One should be thankful to Krishnaswami Ayyangar's family for bringing out this valuable CD. I only hope that all the mathematical articles of AAK would eventually become available in a single volume at a future date.

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*The contents of the CD are available at <http://www.ms.uky.edu/~sohum/AAK/PRELUDE.htm>.