

郭启庶 陈雨光 梁特猷 著

**ZHU-MATHEMATICS**

—— *theory and practice  
of modern zhusuan*

珠数学

——现代珠算的理论与实践

中南工业大学出版社

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郭启庶 陈雨光 梁特猷著

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## 中国科学院系统科学研究所

孙克宁先生：

我把即会寄来的段与书以及 Reader's Digest  
及印件都寄了去。其余的关于信件恕难  
寄奉。

我粗略看了一下 Reader's Digest 及与即会的  
序言与前言说明，颇觉耳目一新，有好多是过去  
不知道也从未想到的（例如关于性大误差作  
中已有特殊的代数方法已抗否否故与介线性误差方机）  
即先生有不少种以否法，可惜我没有时间，只能  
以后在有空时再拜读，请代方向即先生致意。  
尤其感谢！此祝

陈宁

— 欠欠 欠  
93/9/2

珠算革新吟 (六首)

——赠郭启杰、梁特猷、陈雨光同志

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- 五、此乃大工程 于今初发轫  
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- 六、信息新时代 事业属千秋  
重任在我辈 勉哉为国谋

(注) 吴文俊<sup>先生</sup>于1970年创办“中国科学院数学机械化研究中心”，其所创造“吴氏方法”近十年来成为国际数学研究热点之一。(Wu Method)

孙克定

于中国科学院系统科学研究所

1973年9月14日(时年八十四)

## 序

在现代，人们对下列几个公式大体上不会持异议：

现代人 = 生理结构 + 文化知识

文化知识 = 数学 + 其他

数学 = 基础数学 + 中、高层数学

其中“文化知识”应是广义的，包括道德修养和各种技能、技巧等等。其中突出了数学，这不只是属本书主旨，更重要的是它已经成为现代知识结构中最具普遍意义的必具成分，须予着重提示。

通观此书，重在在上述公式的基础上建立或构造下述公式：

基础数学 = 算术 + 几何 + 珠数学

所谓珠数学，乃是建筑在中国珠算基础上的数学。这是非常具有创新意义而富时代感的。

象人类生活需要各种维生素一样，虽然缺少其中某种也能存活，但肯定难获健康成长，甚至酿出疾病。文化知识于人也有多方面的需要。仅以数学来说，历史上曾经只在算术或只在几何上求数学的发展，实践证明只有当算术和几何共同建构成数学的基础才健全得多。随着科技的发展，特别是电子计算机和信息传输数字化，算术与几何对一些数学基础问题的解决已显得不够。经过本书作者们的努力，发现如果再加上珠数学构成三足鼎立的基础上建立更新的基础数学，将会较完美地适应时代的状况和要求。

谈到珠算，开始人们只是认识到它很实用，因而看重它，熟练它。只是到近、现代人们才逐渐认识到它还具教育功能，不仅对数学知识的教育有启迪作用，而且能培养人们良好的品质，如树立准确和效率观念，养成数量分析的习惯，培育严谨坚毅的作风等等。还能一般地开发人的智力和大脑潜能（尤其是开发右脑）。如我国首创的以珠算、笔算、口算有机结合的数学教学，就一再证明上述的事实。日本学者荒木勋在70年代就写了《学习珠算可以增强脑力》的论著。美国人更是主要从教育功能考虑，把珠算当作新文化引进，并向世界推介。目前，全世界研究珠算的大都已注意到珠算的教育功能方面。可以说人们认识珠算已进入到了第二阶段。

问题是还有没有进一步去认识的必要呢？显然，仅就它已呈现的功能和如此实用不衰，就值得探寻究竟。再从反面想，今天电子计算器（机）日益多起来，价格也不比算盘贵，为什么象银行那样已电算化的部门还常备算盘？一般商店更是如此？这中道理值得深究：即它必然存在着作为科学知识和技能、技巧的特点。

本书志在建立珠数学而且作为基础数学。这就要求超越第二阶段的认识，对珠算作更深的发掘。以今天处于非常重要地位的时间、效率这样的观念内容来看，这也是电子计算机科学的主要要素，然而，原来作为数学基础的算术与几何的任何一本书，都没有从时效上作过分析，只是追求如何正确无误而已。珠算则具有很强的时间、效率观念，一操起算盘便情不自禁地想简捷的办法以求快而准。对比起来，即此已显算术和几何作为数学基础的不足；再从数形结合的数学思想方法上看，本书以事实为据从算法论的角度等等方面，说明珠算具有许多本质特点，是现代数学所需要而又是算术和几何所无法包容或代替的，正好起补充作用。

不少推崇数学公理化思想的数学界朋友，认为珠算缺乏逻辑性，担心在数学中引入珠算会削弱逻辑，怕引起不良后果。这其实是一种误解。公理化只是一种整理知识的方法，并非某种知识本身固有的特性。珠算过去以体现中国数学机械化思想作处理，并非不能按公理化方法处理。本书就用了公理化方法建立起与自然数算术（如皮亚诺算术）相平行而又独具特色的珠算术，并且把自然数算术与珠算术融合起来，应该说这是合乎理想的算术。珠几何（点阵几何）无论从理论上看还是从实用看，都是具有深远意义的新的基础几何学。由珠几何而普通几何（如欧氏几何）将是学生学习的→条最好的途径，二者相互结合，离散与连续相互作用，将获得良好的效果。珠算所体现的机械化思想和与电子计算机维妙维肖的系统是令识者惊服的，珠算是现成的图灵机（至今是所有电子计算机的“灵魂”）。珠算法论是最具普遍意义的机器算法论，……。凡此，还未见有谁能拿出确凿的事实来论证珠算会对数学、数学教育产生点滴的不良影响。事实将证明以算术、几何、珠数学把中西数学在基础上融合起来，必将既弘扬了华夏文化精华，又吸收消化了世界优秀文化，为科技的发展做出贡献！

珠算理当作为数学不可缺少的基础之一，可以说是对珠算的第三阶段的认识；看到了它包含的数学之优良“基因”和所以具有独特的实用意义和教育功能。笔者作为过来人，深感获得这些认识是不容易的。正象人类呼吸空气几十万年，真正认识空气于人的利害不过是百来年的事。愈是司空见惯，愈是难得被重视被探索。对珠算的现代研究严格说还是本世纪60年代余介石教授、孙克定研究员、沈百英教授、华印椿先生、王守义先生、郭启庶先生和笔者等当年一些搞数学和数学教育的热心者搞起来的，算来也只30多年，本书作者们相对年轻且钻研有方，又经这十多年的勤奋，应该说已是持之有故，言之成理，



蔚然有序；尽管限于篇幅，却提出并初步展开了许多耐人探味的课题，足资研究。深深为之忭贺！

据笔者所知三位作者分隔千里，素不相识，通过《现代珠算》（梁特猷先生创办并任主编十年）以文会友，从而对珠算之科研价值深得共识，切磋鼓励，以沫相濡，坚定了深入研究的决心。

这期间，作者们对提高认识使思想飞跃到一个新高度，更得力于获读《吴文俊文集》（只印行570册，一般很难读到）。吴文俊先生精辟分析、正确评价和高度概括了中国古代数学伟大的历史意义和现实意义，指出：“贯串在整个数学发展过程中有两个中心思想，一是公理化思想，另一是机械化思想”。

“公理化的思想导源于古希腊，机械化的思想则贯串于整个中国的古代数学”，“都曾对数学的历史发展做出了巨大的贡献”。“这两种方法的溶合，或许能为数学的未来发展提供一些新的摸索经验。”据目前我国情况，重视公理化思想颇呈定势，应该强调的是重视机械化思想使二者溶合。“问题不在于能不能成不成，而在于愿不愿做不做，也在于肯不肯敢不敢。”（引号内的话均引自《吴文俊文集》）

郭启庶先生本在珠算基础理论，珠算高级算法、珠算与电脑的关系等方面开展了比较系统的研究，并有一些领先的成果；陈雨光先生在从事电脑教学之余建立珠算算法语言，并在灰色系统中成功运用，取得开创性成就。他们受吴文俊先生的启发，更加集中于珠数学——现代珠算的理论与实践的深入挖掘，逐渐获得本书的有关成果。作者们为道愈钻愈觉有意义，愈钻愈感到兴奋和喜悦。笔者读后也完全获同感！

本书酝酿于1990年，直至1993年6月经作者们的相互磋商始完稿。其中第1至11章由郭先生撰写，第12至14章由陈先生

撰写，最后由梁先生校订并再与郭先生共同参阅后定稿，也是说明作者们态度之严谨。梁先生年逾古稀，宿疾缠身，承担联系出版与校订的工作，且竭力张罗资金以助梓。中南工业大学出版社乐为之印行。当此出书难，出理论著作更难，出珠算理论著作尤难。因此，乐就所知，道其情况，既属科坛佳话，亦见世道人心，殊为引慰！

无论就珠算或就数学来看，目前尚未见有与此同类的书。路是走出来的。尽管本书成果属初步，但跨出了这最重要的第一步是特别值得庆贺的！做为60年代参与珠算研究而今已入老耄之人，确知作者们的努力有成，行见有为青年将络绎为之续作、丰富、发展！不禁欣然为序！

河南大学教育系教授

陳梓北

1993年8月

## FOREWORD

In April 1987, READER'S DIGEST Published "New conquest for the ancient abacus" by JAY STULLER. At the beginning the article "Throughout the West, math teachers are learning that this venerable Chinese tool ① can solve a number of problems in the classroom." "Today the abacus, Out of favor in the West for nearly half a millennium, is being rediscovered by Western educators as an incomparable device for teaching the principles of mathematics, far better than pencil and paper, electronic calculators or computers." Lastly, it reads "Whether students are blind, speak Chinese, English, Spanish, French, Portuguese or German, numbers are all the Same. The language of the ancient and still remarkable abacus is universal." There are numerous facts citing in writings. They have shown the zhuan ① results of raising universal teaching quality of basic mathematical education in United States, Mexico, West-Europe and many other areas, causing world educational circles to pay great attention.

This three thoughts and methods of maths: zhuan, calculation by writing and mental arithmetic have made an organic combination for mathematical

education, which was initiated by a primary school teacher of Yichun in Jiangxi Province of China, in the 1959. By early seventies, the achieved experimental results were popularized to schools all over the country. In the late seventies, the delegation of zhusuan educational circles of Japan visited China and understood these achievements. Presently, they got on the experiment in Japan and achieved good results too. Soon afterwards, they past on this experience to SORBAN INSTITUTE OF THE UNIVERSITY OF SOUTHERN CALIFORNIA SCHOOL OF EDUCATION (U.S.C.). U.S.C. introduced this experience to a broader Scale in experiment and popularization. The above-mentioned articl was published in READER'S DIGEST. All of this accomplishment of mathematics education with zhusuan was highly affirmed. But we consider this just to make use of the superficial layer effect of zhusuan, to distinguish numbers conveniently and advantageously to raise pupil's interest in study and to calculate fast with their own hands.

In winter of 1990, I visited U.S.C. in Los Angeles and met with the Director, Dr. Leo Richards. Both of us believed that it is important to enhance academic research of zhusuan and its functions in the educational process. Dr. L. Richards has also repeatedly emphasized that zhusuan has contents which are far more significant than just being fast and pre-

cise in calculation. Zhusuan is also creating maths.

Early before 1986, Mr. Guo qi Shu and Mr. Chen Yu Guang and I, Who are co-authors of this book, hade paid attention to the fact, that zhusuan must replenish the foundation for modern maths. We are evoked intuitional to engender the above—mentioned understanding——Suanpan ① just a ready-made Turing machine. ② Thus it impelled us respectively with each of mathematical thought, theory of algorithms, algorithmic language etc. for recognizing zhusuan once again in a systematic way, to launch study of zhu-maths (maths build up the foundation of zhusuan—the gist of this book) step by step. Therefore, Our above-mentioned ideas arouse sympathy with Dr.L. Richards. Afterwards, I sent him by post a XIANDAI ZHUSUAN (the periodical of academic research in comtemporary zhusuan ) of which I was the chief editor in 1980~1990.

The puplic, who has long-term to embrace Western mathematical educational, would unavoidably take the axiomatization maths which originated from Euclid of ancient Greece as the only main current. Morris Kline, one of the most esteemed of the western maths circles and author of **MATHEMATICAL THOUGHT FROM ANCIENT TO MODERN TIMES**

(1972), admitted that he himself has failed to give attention to several other cultures, like those of China, Japan and the Maya's. However, in the annota-

tions, he mentioned that Joseph Needham's SCIENCE AND CIVILIZATION IN CHINA published by Cambridge university press in 1959 had encouraging accounts about the history or mathematics of China (volume III, pp.1~168) .

In fact, Chinese ancient maths (1000B. C.~1600 A. C. approximately) was another main current developing much earlier in ancient than in Greece. It has showed ingenuity, and taken dominant on both the number with form in maths(similar analytic geometry) and maths mechanization (inflexible or norm) , keeping pace all along with the western maths and contribution greatly to the development of maths in the world. Scholars such as Mr. M. Kline, who is a well-known historian of maths, are not the only ones that fail to fully understand this point. Mathematicians and educators in modern and contemporary China are so heavily influenced by western axiomatic maths that few of them have engaged themselves in the indepth study of maths in ancient China which is extensive in knowlege and profound in scholarship. Chinese ancient maths thus was cast away out maths education in China.

With the extensive use of computers, calculative maths has attracted great attention. Prof. Wu wen-jun, a presidium member of the Board of Academicians of the Chinese Academy of Sciences, has resolved the difficult problem of "machine-proved the-

mathematical theorem" by applying the mathematical thoughts of ancient China. His way of calculation is now generally accepted by the mathematical and computer circles of the world as the "wu Method". It shows that mathematical thoughts of ancient China which are based on the numbers close with form and mathematical mechanization has not only been applicable in the past, but can also meet the needs of the current situation and the development of modern science and technology.

As a product of mathematics in ancient China, zhusuan is deeply rooted in the ancient Chinese mathematical thoughts. This book has made systematic explorations for ways in which the mathematics of zhusuan can be supplemental to arithmetic and general geometry in order to conform and contribute to the basis of modern maths, and has raised subjects for further research. The book has covered preliminary research results only, but it will undoubtedly offer an example and inspire more thoughts in terms of enriching the basis of modern mathematics and improving mathematical education. Again as Dr. L. Richards has correctly pointed out, zhusuan has contents which are far more profound than just being fast and precise in calculation. Zhusuan is also creating maths.

by Te You Liang

Hunan Finance and Economy College of

China

August, 1993

Notes:

① "Chinese tool" and "abacus" as are used in the article cannot give precise descriptions to the readers. Instead, the original Chinese term "zhusuan" should be used, because it refers to something that is completely different in structure, usage and function from what the word "abacus" denotes. In addition, "zhusuan" also means "to calculate" with "suanpan" (the Chinese abacus) .

②Allan Mathison Turing (1912—1954) made significant contributions to the logical analysis of the computer process. Nowadays computer, either giant or micro ones, still base their computerization on the "Turing computer" .



# 珠 数 学

## ——现代珠算的理论与实践

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