

Tentative Analysis on the Reasons of China's Lags in Neoteric Mathematics¹

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(Received April 16, 2008. Accepted May 5, 2008)

Before the 14th century, China had been thought as one of the countries with the most developed mathematics all along. But after the 16th century, Chinese mathematics increasingly walked up to the eclipse. The main reasons include the following points. First, the development of neoteric mathematics was closely associated with the social industrialization, but the lags in feudal China seriously blocked the development of the capitalistic seed, and China was still in the agricultural society then and couldn't step into the industrial society, which impeded the development of mathematics concerned with the industry and commerce. Second, the increasingly carrion feudalization was one of the essential reasons to block the development of Chinese neoteric mathematics. Finally, seeing about the developing logics of Chinese neoteric mathematics, we can find it was a scattered and experiential mathematical knowledge without strict and rational self-organizing structure system, which had the limitations existing in its interior mechanism.

Keywords: Chinese neoteric mathematics, reasons of lag, interior mechanism, exterior mechanism

ZDM Classification: A30, D30

MSC2000 Classification: 01A07, 01A80

0. INTRODUCTION

Guo & Zhang, Xiao-lei (2001) investigated the real reason of decline of ancient Chinese mathematics after Ming Dynasty and found some enlightenment from it through contrasting the feature of the ancient Chinese mathematics with the one of western mathematics and analyzing the characteristic of the social and culture of the ancient

¹ This paper will be presented at the 40th Korean National Meeting of Mathematics Education at Seoul National University, Seoul, Korea; May 16-17, 2008.

China.

According to “Yearbook of Natural Science Development” published in 1975, before Ming Dynasty, there were about 300 important inventions and scientific achievements in the world, and China possessed about 175 items accounting for over 57% of the total. In his researches, Dr. Joseph of British University of Cambridge pointed out China exceeded contemporary Europe much in the inventions and discovering. The Chinese ancient science and technology was keeping ahead the world in a long period. These scientific knowledge mainly included chronometer, mathematics, chemistry and medicament etc. which were spread to the whole world and made important contributions to the developments of world science and technology.

Chinese mathematics has a centuries-old history, and China was one of countries with the most developed mathematics. China had appeared many outstanding mathematicians which had acquired many splendid achievements. Chinese arithmetical mathematics mode of long standing with the characteristics of process and mechanism focusing on the arithmetic had reflected with the axiomatic mathematics mode with characteristics of deduction of geometric theorem in ancient Greece each other, and they had alternately influenced the development of mathematics. Chinese ancient mathematics had achieved its pinnacle in the period of Song and Yuan dynasties, and many mathematicians such as Qing Jiushao, Yanghui, Liye and Zhu Shijie etc. had acquired a series of outcomes with the world historical meanings. But after Zhu Shijie’s “Jade Mirror of the Four Unknowns”, because of many complicated reasons, Chinese mathematics increasingly walked up to the eclipse after 16th century and finally joined in the tide of modern mathematics coming through a long and difficult developing course.

In fact, Zhu Shijie’s “Jade Mirror of the Four Unknowns” could be thought as the peak of poetic perfection of mathematics in Song and Yuan dynasties. In the late of 14th century, Chinese traditional mathematics suddenly began to comedown. The mathematical level in Ming Dynasty was far lower than the level in Song and Yuan dynasties, and the mathematicians couldn’t understand the “Zeng-Cheng method for the extraction of roots”, “Tianyuan method” and “Quaternion” acquired by their ancestors. The mathematical bookmaking in Han, Tang, Song and Yuan dynasties didn’t have no new block-printed editions in Ming Dynasty, on the contrary most were lost. Before the Qian-Jia school newly researched in the middle of Qing Dynasty, the mathematical quintessence in Song and Yuan Dynasty such as “Tianyuan method” and “Quaternion” actually was lost for a long time and no one made acquainted with them. Though the agriculture, industry and commerce in Ming Dynasty were still developing, and the west books such as “Elements of Geometry” had been introduced into China, but the ruling of feudalism, eight-part essay and large scale of literary inquisition limited people’s ideas and cut the throat of the free creation. Until to the late of Qing Dynasty, there appeared Li

Shanlan, who was the forerunner and disseminator of neoteric science. However, because the Chinese mathematics of the time had far trailed the west, it had no force to pursue the advanced mathematical level of the west only depending on few Chinese mathematicians such as Li.

There were various reasons to induce the comedown of Chinese traditional mathematics from the late of Yuan Dynasty. The feudality with alternate dynasties put up increasingly serious stagnancy and molder in its late period, which induced the mathematical development was short of social impetus and idea stimulation. After Yuan Dynasty, the "calculating section" in imperial examinations was completely abolished. The officials only come from eight-part essay examination, and the social status of mathematics was low. The persons who studied mathematics had no future and the free discussions were restricted even forbidden. At the same time, the Chinese traditional mathematics had weaknesses themselves. Though the decimal notation used in the arithmetic system was a contribution to the world civilization, but the arithmetic system itself had much limitations. The half symmetric algebra developed in the frame of arithmetic could not breach these limitations to evolve the complete symmetric algebra. The operation of arithmetic equation was not only awkward, but helpless to the equation groups which had five and over five unknowns. In the other hand, the creation of arithmetic was the necessary factors to make mathematics progress, but both the arithmetic tendency lacking in the deduction and the deduction tendency lacking in the arithmetic creation were difficult to sublime to the modern mathematics.

That is to say, in the neoteric time, both the interior and exterior mechanisms of Chinese mathematics had produced essential changes. We will discuss the reasons of the lags in Chinese neoteric mathematics from two aspects including the exterior mechanism and interior mechanism of mathematical development in the following text.

1. THE LAG REASON OF EXTERIOR MECHANISM IN CHINESE NEOTERIC MATHEMATICS

The reasons of exterior mechanism mainly include the influences of many factors such as the regime, economic structure and political system in the temporal China to the mathematical development.

First, the feudality, lag and the close-door diplomatic policies in neoteric China seriously blocked the budding development of capitalism and the mathematical development concerned the industry and commerce. In the neoteric times, human society began to enter the industrial society from the agricultural society. And the reason which induced this transform is the industrial revolution which happened in the west. From the

late of 17th century to the first half of 18th century, man invented steam engine and spinning machine which soon were applied in the every social domains, which induced the first industrial revolution and the appearance of industrialization society. Because the uses of steam engine and other machines formed machine building, large numbers of mechanical problems were put forward. For example, Galileo established the mechanics on the ground, Kepler established the mechanics in the universe, and Newton integrated both sides, established the uniform mechanics system and wrote the book of "Mathematical Principles of Natural Philosophy."

The appearance of industrialization society brought more new problems for mathematics and request mathematics to solve them. Especially the quick development of mechanics and the establishment of its system info gave mathematics more promotions. Obviously, the accomplishment of three industrial revolutions was all based on the corresponding mathematical theory and the naissance of several important mathematical theories was going with the ongoing industrial revolution. For example, the steam engine and spinning machine in the first industrial revolution were based on the calculus and the dynamotor, electromotor and electric communication in the second industrial revolution were based on the electromagnetism theory and mathematical analysis. So we can say, the agriculture and astronomy were the important impetus for the development of ancient mathematics, and to the neoteric times, industry and commerce and mechanics became the important impetus for the mathematical development.

The neoteric China was still in the agricultural society. Though the bud of the commodity economy had appeared, but because of many reasons this bud had not grown up, which finally decided that China impossibly possessed machine manufacture and impossibly walked up to the industrial society from the agricultural society of course. And there were not much new problems need to be solved depending on the mathematical principle in the agricultural society. China had not entered into the industrial society in the neoteric times, which lost the new opportunity of social background required by the mathematical development. The old power had been exhausted but the backup power couldn't come into being. This seriously influenced the development of Chinese neoteric mathematics.

Second, increasingly carrion feudality is one of the essential reasons to block the development of Chinese neoteric mathematics. The rulers in Ming and Qing dynasties performed absolutism policy on the culture. The family privileges made the vested interests become unparalleled hugeness and banning on maritime trade suppressed the bud of the capitalism. Freaky official appointing system, military slavery, eight-part essay and letter jail seriously restricted the highbrow minds and made them broke from the practice, production and the study to the nature, and blindly immersed into the "Four Books" and "The Five Classics". Taking the letter jail as an example, one of the essential

differences between Qing Dynasty and at the beginning of the Ming Dynasty was the letter jail in Qing Dynasty took the whole Han nationality as the striking objects, and the striking range was illimitably extended to the folk people. But the letter jail in Ming Dynasty had only performed early for a little time, and the range was also limited in the interior of the ruling group. No matter what in scale or the characteristic, both were different. This not only made the outcomes of emancipating the mind at the late of Ming Dynasty lost completely but made the learning from the west had no folk mind foundations at the late of Qing Dynasty, and finally Chinese learning from the west became similar in shape but different in spirit.

Looking through the ancient history of Chinese mathematics, most mathematicians engaged in their fond mathematical researches when they acquired official titles through eight-part essay. They had not colony research institution and data information center such as Grecian Alexander University and library, and could but foster mathematics by liberal art or official salary and were short of the medium of intercommunion. In this way, they could not devote themselves into the research. Taking the Song Dynasty with rapid progress of mathematics, most mathematicians were born from low class bureaucracy, and their attentions mainly focused on the problems concerned by the civilians and skilled workers, so they would ignore the theoretical works.

Third, for a long time, the autarkic small-scale farming possessed obvious characteristics of decentralization and parochialism and could not make mathematical application achieve the lager scale, which accordingly made the generation and application of the neoteric mathematics lose its necessary soil.

2. THE LAG REASON OF INTERIOR MECHANISM IN CHINESE NEOTERIC MATHEMATICS

The biggest weakness of Chinese traditional mathematics is that it lacks in a sort of idea of strict demonstration, the situations of pursuing mathematics for mathematics were very few, and this point which was same to the bookman lusting for official positions could be attributed to a sort of utilitarianism. From the view of contents, most main achievements in mathematics and scientific technology belonged to applied science, only settled for the actual application and could not form the ethos of theoretic discussion and strictly rational thinking.

From the view of the research methods, Chinese traditional mathematics mainly adopted traditional methods through cleaning up books and summarizing experiences, but in fact the scientific experiments was the foundations to establish the neoteric science. Without experiments, it can not find out the interior rules in things from the surface to the

inner. That is to say, Chinese scientific technology usually rested on the experiential shape, and it lacked in the strict system info of neoteric science in Europe and didn't educe the universal scientific rules and principles. This also shows Chinese traditional mathematics has its own obvious limitations.

Of course, the utilitarianism has its social root and Chinese always firstly apply themselves to the problems which the ruling class wants them to solve. In the ancient China, the essentiality of mathematics mainly embodied in the relations between it and calendar, and the latter would become a privilege firmly grasped by monarchs because of belief concerned (such as the origin of Pythagorean Theorem). From the view of technique, most mathematicians engaged in researches by means of annotating the formers' bookmaking, which fully demonstrated that the social mechanism could not encourage people's subjective initiative and mathematicians lacked in courage to start new world, so that those most outstanding brains always surrounded several age-old problems such as the ratio of the circumference, the calculation of sphere volume, the solution of high-degree equation and the sum formula of arithmetical series.

However, the interior mechanism of neoteric mathematics also produced essential changes. The theoretical degree of mathematics became more and more high and the branch subjects became more and more, which induced mathematics increasingly form a big system where the factors in the interior of the system acted each other and produced stated structure and arrangement, the interior antinomy was increasingly strengthened, accordingly drove the appearances of abundant new mathematical outcomes. For example, many important outcomes of neoteric mathematics such as analytic geometry, calculus, non-Euclidean geometry and group theory etc. all came into being in the mutual interior collisions of this self-organizing structure.

It is obvious that up to the neoteric times, the functions of mathematical interior mechanism became more powerful, and the influences added from the exterior function which gave mathematics huge impetus make the west neoteric mathematics grew up rapidly. Nevertheless, when we reviews the developing logics of Chinese neoteric mathematics, we can find it was a scattered and experiential mathematical knowledge without strict and rational self-organizing structure system, that is to say it had "natural deficiency" or self weakness, which induces the interior developing impetus of Chinese neoteric mathematics had been almost exhausted. So Chinese neoteric mathematics cannot but be in the stagnation and the lags are inevitable.

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