

SAW Seminar: Mathematical practices in the context of the astral sciences

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Zhu Yiwen (Sun Yat-sen University)

The Use of a traditional method (Fangcheng) in Calendric Calculations in ancient China

Abstract: When dealing with the mathematical book by Qin Jiushao 秦九韶 (1208-c.a.1261 C.E.), *Nine Chapters on Mathematical Treatises* (*Shushu Jiuzhang* 數書九章, hereafter abbreviation *SSJZ*), most scholars have focused on the conspicuous mathematical achievements that the procedure named “*Dayan zongshu*” (大衍總數術) represented. From the viewpoint of modern mathematics, this procedure deals with remainder problems, and relates to the so-called “Chinese remainder theorem”. According to Qin Jiushao, the procedure was used in calendric calculations to search the accumulated years from the very origin point of the calendar till the present (*Shangyuan jinian* 上元積年). Since an earlier mathematical book, *Mathematical Classic by Master Sun* (*Sunzi Suanjing* 孫子算經), contained a problem dealing with remainder questions, and since there was a date for the accumulated years in *Santong* calendar (三統曆) compiled during western Han dynasty, Qian Baocong (錢寶琮, 1892-1974) argued that the procedure was already used during the Han dynasty. Li Jimin (李繼閔 1938-1993), by contrast, suggested that at the time of the Han dynasty officials used another procedure, namely *Yanji* procedure (演紀法), and not *Dayan Zongshu* procedure. Qu Anjing (曲安京) embraced Li Jimin’s viewpoint. He further argues that only a few astronomical parameters were involved in the calculations of the accumulated years.

Taking Li Jimin’s and Qu Anjing’s thesis as a starting point, in this presentation, I focus on a key procedure, namely *Fangcheng* (方程), a procedure solving systems of linear equations and to which chapter 8 of *The Nine Chapters on Mathematical Procedures* is devoted. I want to offer an interpretation of a statement by Qin Jiushao in which he asserts that the *Fangcheng* procedure astrological officials used amounts in fact to *Dayan zongshu*. I argue *Fangcheng* procedure was a core for the *Dayan zongshu* procedure. For this, I suggested there were actually two kinds of procedures falling under the general *Fangcheng* procedure, as presented in *The Nine Chapters on Mathematical Procedures*. Given the fact that Qin Jiushao’s book is the only remaining source recording the calculation for the accumulated years, therefore, on one hand, we lack earlier sources; on the other hand, this raises the question of why Qin Jiushao wrote it down. Taking my study on *SSJZ* as a basis, I shall offer a hypothesis regarding what Qin Jiushao actually did on the so-called the remainder theory.

My talk aims at gathering all the sources on this issue from the Han dynasty to the Song dynasty. On the case study of *Fangcheng* or *Dayan* procedures, I will further study the relationship between mathematical procedures and astronomical calculations. Qin Jiushao divided mathematics into two parts: the inner mathematics (內算), which was in relation to astronom-

ical calculations, and the outer mathematics (外算), which referred to the mathematics presented in mathematical canons. I shall try to analyze the interplay between the two.