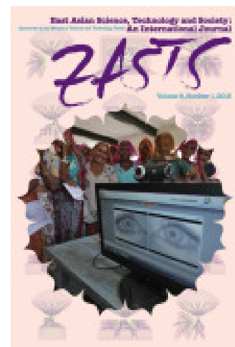
Ancient Chinese Mathematics in Action: Wu Wen-Tsun's Nationalist Historicism after the Cultural Revolution



Jiri Hudecek

East Asian Science, Technology and Society: an International Journal,
Volume 6, Number 1, 2012, pp. 41-64 (Article)

Published by Duke University Press

East Asian Science, Technology and Society: An International Journal (2012) 6:41–64
DOI 10.1215/18752160-1506346

Ancient Chinese Mathematics in Action: Wu Wen-Tsun's Nationalist Historicism after the Cultural Revolution

Jiri Hudecek

Received: 28 March 2011 / Accepted: 19 September 2011

Abstract The article attempts to theoretically explain the origins of the nationalist and historicist turn of the Chinese mathematician Wu Wen-Tsun (born 1919). Wu returned to China from France in 1951 as an internationally recognized expert on algebraic topology, but his career was frustrated by political disruption and isolation from international research, especially during the Cultural Revolution (1966–76). After he studied ancient Chinese mathematics during the 1974 campaign against Confucianism (Pi Lin Pi Kong 批林批孔), he defended its relevance for modern mathematics and set out to demonstrate it in his own work. This coincided with Wu's reorientation from algebraic topology to mechanization of geometric proofs. Wu claimed that ancient Chinese mathematics inspired the method he developed, both by its general style and by specific techniques. His use of ancient Chinese mathematics was connected to his calls for an independent mathematical tradition in China. I argue that he turned to nationalism to protect himself from the "uneven development" of mathematics, in analogy to Ernest Gellner's theory of nationalism. The early success of his method of mechanization, however, resulted in more dependence on world mathematics, and a revival of ancient Chinese mathematics has not occurred.

Keywords Wu Wen-Tsun (Wu Wenjun) · mechanization of mathematics · nationalism · historicism · Ernest Gellner

I wish to thank my supervisors, Dr. Eleanor Robson and Prof. Catherine Jami, for their devoted support during my research; Dr. Horumi Mizuno and the two reviewers for their suggestions to improve the manuscript; Dr. Leon Rocha for an insightful discussion of an earlier version of this paper presented in the Department of History and Philosophy of Science, University of Cambridge; and the Trustees of the Needham Research Institute for generous funding of my research trips to China.

J. Hudecek (✉)
Department of History and Philosophy of Science, University of Cambridge, Needham Research Institute, 8 Sylvester Road, Cambridge CB39AF, United Kingdom
e-mail: jh602@cam.ac.uk

1 Introduction

> Ancient Chinese mathematics has a lot we can inherit, elaborate upon and study in order to develop a truly modern socialist mathematics in our country, be it the content and subject matter, the modes of expression, the spirit of its thought or the research methods.
> (Wu 1976b: 16)

In the November 1976 issue of the newly established *Journal of Applied Mathematics* (*Yingyong shuxue xuebao* 应用数学学报), Wu Wen-Tsun 吴文俊,[1] one of its editors, published an article titled "The Cultural Revolution Opened up a Broad Future for Mathematical Research." It was a praise of the results of the Cultural Revolution in Chinese mathematics, documented on Wu's own intellectual transformation since 1966, but also his manifesto for the future. Wu listed lessons learned from productive labor among the masses, from the study of Marxist-Leninist classics, and from Mao Zedong's thought, predictable points in any piece of writing of this period. But alongside these obligatory topics, Wu highlighted how recent years enabled him to understand ancient Chinese mathematics[2] and draw inspiration from it.

Unlike Marxism-Leninism and proletarian consciousness, ancient Chinese mathematics was politically acceptable but certainly not prescribed as a subject of study in the 1970s. Wu, an algebraic topologist educated in France and author of influential concepts and theorems used by several Fields medalists, focused on it by his own choice. His affection for ancient Chinese mathematics was to become notorious and was already shaping his mathematical research. Weeks after the above article appeared in press, Wu designed a method of mechanization of proofs in elementary geometry, which he repeatedly presented as the first step of a revival of the style of ancient Chinese mathematics. Ancient Chinese mathematics, he argued as early as 1978, had an algorithmic, "mechanized" character, which made it particularly well suited for the coming age of computers and the "mechanization of mental labor" (Wu 1978a).

Emotional claims about modern relevance of national traditions, unfairly ignored by "mainstream" historians, are not restricted to China, although their prominence there is striking (Zhang 2001; Amelung 2003). Wu went far beyond this: for him, ancient Chinese mathematics is not only a potential source of national pride and self-confidence but also a resource for nation building. In this essay I try to show that Wu's road to this position, which I call "nationalist historicism," follows a pattern described by political scientists studying the more general phenomenon of cultural nationalism. In particular, Wu's motivations and justifications for a revived, independent Chinese mathematics are remarkably similar to the theoretical model for origins of cultural nationalism proposed by Ernest Gellner (1964), and his historicism can be classified

[1] The name 吴文俊 should be transcribed "Wu Wenjun" in the official transcription pinyin. Wu has, however, consistently used older romanizations, either as "Wu Wen-Tsun" or "Wu Wen-Tsün." I will use the former version, following his recent *Selected Works* (Wu 2008).

[2] "Ancient" *gudai* 古代 is used by Wu loosely for the entire period up to about the seventeenth century, when the impact of Jesuit translations of Western mathematical works transformed Chinese mathematics. On a few occasions, he also talked about "traditional" *chuantong* 传统 Chinese mathematics. This seems historically preferable, but for simplicity I will follow Wu's earlier wording, which he has never completely abandoned.

as “reformist” according to Anthony D. Smith (1981: 87–107). Wu’s extraordinary extension of cultural nationalism to mathematics must, however, be understood on the basis of his life and mathematical career in twentieth-century China.

The next section therefore summarizes Wu’s biography, highlighting two main aspects: his socialization in the international mathematical community and the obstacles Wu’s mathematical career faced because of China’s international and internal political situation. The third section looks at the triggering event of Wu’s turn to historicism, the “anti-Confucius, anti-Lin Biao” campaign (Pi Lin Pi Kong 批林批孔) of 1974. Wu adapted the motto of this movement, to “make the past serve the present” (gu wei jin yong 古为今用), from its common interpretation (serving current ideology and politics) to a new goal: to reevaluate ancient Chinese mathematics by demonstrating the importance of its inventions for the development of world mathematics.

After the end of the Cultural Revolution (see section 4), Wu designed his method of mechanical theorem proving and also focused his praise of ancient Chinese mathematics on a few of its characteristics. These abstract characteristics were positive in his own philosophy of mathematics and predisposed, in Wu’s view, ancient Chinese mathematics for an important role in the era of computers, or “mechanization of mental labor.” Wu supported his appraisal of ancient Chinese mathematics by claiming a direct inspiration of his method in an old Chinese technique—a connection that is credible and plausible, but its overall significance should not be overestimated.

Then I analyze the whole story again using Ernest Gellner’s theory of origins of nationalism in uneven development and Anthony D. Smith’s classification of routes to historicism. They explain the underlying psychological patterns of these phenomena, which are present, with appropriate modifications, in Wu’s case as well.

The epilogue briefly assesses Wu’s successes and failures in his twin program of reviving traditional Chinese mathematics and promoting mechanization. Although Wu has enjoyed many awards and government support since the 1990s, and also respect from Chinese historians of mathematics, his brand of historicism and cultural nationalism remains exceptional in China.

2 Abroad and at Home: Wu Wen-Tsun’s Life and Mathematical Career up to 1975

Wu Wen-Tsun was born in Shanghai on 12 May 1919, into a middle-class family of a typesetter with Western-style education. Wu enrolled at the Department of Mathematics at the Shanghai Section of the National University of Communications (*Guoli Jiaotong Daxue Shanghai Benbu* 国立交通大学上海本部) in 1936. In late 1937, Shanghai was captured by the Japanese army. A minor part of the National University of Communications had moved in advance to inland China, but most teachers and students, including Wu, stayed in Shanghai and reestablished the university in the French concession. After graduation in 1940, Wu taught elementary mathematics at schools until the Japanese surrender in 1945 and at the Provisional University *Linshi Daxue* 临时大学 afterward. In 1946, he became one of the research trainees of S. S. Chern (Chen Xingshen 陈省身, 1910–2004), a famous differential geometer who had spent long years in Germany and France and now headed the Preparatory Office for the Institute of Mathematics (Shuxue yanjiusuo choubeichu 数学研究所筹备处) of Academia Sinica (Hu and Shi 2002: 2–31).

Chern taught all his young colleagues topology, a subject undergoing a major transformation in this period, with increased use of abstract algebraic concepts and techniques. Wu quickly demonstrated his talent for the discipline by deriving a simple proof of Hassler Whitney's product formula for characteristic classes of sphere bundles (Wu 1948). In 1947, he won a government scholarship to study in France and spent the next four years in Strasbourg and Paris, studying under leading figures of French algebraic topology, Charles Ehresmann (1905–79) and Henri Cartan (1904–2008). He derived several important results in the theory of characteristic classes and collaborated with young members of the French school of algebraic topology, who were transforming the discipline in this period (Dieudonné 1989). Wu befriended René Thom (1923–2002) and introduced him to Pontryagin characteristic classes (which he had learned from Chern). This was crucial for Thom's development of cobordism theory, for which Thom received the Fields Medal in 1958 (Thom 1990: 3). As a research fellow at Centre national de la recherche scientifique in Paris (1950–51), Wu also had frequent contacts with Jean-Pierre Serre (b. 1926; Fields Medal, 1954), participated in H. Cartan's topology seminar and meetings of the Bourbaki group, and derived two "Wu formulas" about Stiefel-Whitney characteristic classes and their relations via Steenrod squares, which entered standard textbooks on the subject (Milnor and Stasheff 1974). He also contributed a few conjectures later proved by his colleagues (e.g., Adem relations; Cheng 1994: 379–81; Hu and Shi 2002: 33–48; Ke 2009: 53–66; Gan 2010: 129–30; Li Banghe 2010: 3–5).

Although he had offers to remain in France or go to the United States, Wu returned to China in 1951 and became, after an unhappy year as a professor at Peking University, a research professor (*yanjiuyuan* 研究员) at the Institute of Mathematics of the Chinese Academy of Sciences (IMCAS). He cofounded a topology group, organizing a weekly topology seminar (Sun 2010; Gan 2010: 130–32), and continued to develop ideas from his studies in France, trying to establish for the Pontryagin classes theorems similar to those he had found for the Stiefel-Whitney classes (Cheng 1994: 381; Hu and Shi 2002: 50–57). But he was aware that in China he had slim chances for success in the mainstream areas of algebraic topology, which were undergoing rapid development abroad. In a later reminiscence, he wrote:

> After I returned to China in the summer of 1951, I was in a new situation, basically isolated from the outside world, or from foreign countries. I was like a solitary army preparing for war (*gu jun bei zhan* 孤军备战)—how to do research in such a situation? I also realized that my research had for many years been limited to the cutting-edge topology of characteristic classes and fibre bundles. I thought I could perhaps expand my research range.... In order to solve these problems, I made an analysis and survey of trends in the history of topology. (Wu 2004: 15)

This survey led him to believe that classical topological problems (such as classification of topological spaces) were neglected due to the rapid advancement of homotopy theory. He therefore decided to investigate nonhomotopic invariants systematically using tools of algebraic topology (Wu 1953).

This eventually led to the establishment of new embedding classes. By 1957, Wu had proved that a topological realization—embedding—is possible if and only if embedding classes are zero. Wu received the first Chinese National Prize for the Natural Sciences in January 1957 partly for these achievements. He also became, at thirty-eight, one of the youngest members of the Academic Department of the Chinese Academy of Sciences for Mathematics, Physics and Chemistry.

The Chinese government started to invest more money into science in the mid-1950s, and Wu's isolation was briefly alleviated. He attended mathematical congresses in the Soviet Union, Romania, Bulgaria, and East Germany and visited France in May 1958 (Hu and Shi 2002: 57–62). Wu was well known internationally, one of a handful of Chinese mathematicians noted for their originality outside China. He was even invited to give a thirty-minute plenary talk at the International Congress of Mathematicians in Edinburgh in 1958, but he did not attend (Stone 1961). The reasons have not been made clear but most probably were because of China's failed negotiations with the International Mathematical Union (Lehto 1998: 126–29), as well as the unfolding of the Great Leap Forward (1958–61).

Wu's academic career was severely disrupted after 1958 because of the Great Leap Forward campaign. Although the Great Leap Forward focused on agriculture and industry, science was also required to contribute more directly than before to socialist construction, in a mind-set similar to a total war.

The Communist Party of China had always emphasized Mao Zedong's dictum that "theory must be connected to reality" (*lilun lianxi shiji* 理论联系实际) but did not enforce it blindly in disciplines such as mathematics. China had a strong pre-1949 tradition in abstract subjects, whereas modern applied mathematics had to start from scratch. The director of the Institute of Mathematics, Hua Loo-Keng 华罗庚 (1910–85), an expert on number theory, algebra, and complex function theory, tried to promote applications of mathematics to mechanics, computation science, and other related disciplines while keeping space for research on classical problems in abstract disciplines. His balanced approach became an obstacle to the Great Leap Forward enthusiasm, and he was targeted in a major campaign in September 1958, after similar events at Wuhan University and Peking University (Zhongguo kexueyuan 1958; Wang 1999: 240–50).

The results of this campaign "against white flags in mathematics" also affected Wu Wen-Tsun. The topology group and its weekly topology seminar were dissolved, and Wu was assigned to operations research, where he eventually specialized in applications of topology to game theory (Wu 1959a, 1959b). One of the articles he wrote (Wu 1959a) aimed at a popular audience and included an introduction to game theory via the horse-betting story about Tian Ji and his adviser, Sun Bin, from the *Records of the Historian* (c. 90 BCE).[3]

This seems interesting from a later perspective, as the first instance of patriotic history in Wu's writings. But rather than being related to his later sophisticated arguments about ancient Chinese mathematics, it seems to be simply an emulation of the

[3] Sun Bin advised Tian Ji to match his best horse against his opponent's middle horse and his middle horse against the opponent's weakest horse, and to let his own weakest horse lose to the opponent's best horse, scoring two victories in a three-round race (Ssu-ma Ch'ien and Nienhauser 1994: 39–40).

tendency to use Chinese stories for popularization of essentially modern scientific methods and concepts, frequent in the 1950s (see, among others, Hua 1956).

The Great Leap Forward turned into a protracted economic slump, and by 1961 hard-line policies were relaxed to stimulate individual activity. Mathematics witnessed a renewed emphasis on abstract theory potentially important for future cutting-edge science. Wu was encouraged to return to algebraic topology but found the three-year gap disastrous to his ability to catch up with developments in the subject. During his visit to France in 1958, he had presented his ideas on embedding of differential manifolds at a colloquium in Paris. André Haefliger, a Swiss mathematician present at the meeting, used Wu's ideas in a series of influential articles, starting with Haefliger 1961. This had a demoralizing effect for Wu, as he later recalled: "After 1960, when I could work again, I was led to these thoughts: it was me who established the theory of embedding classes, I found a concrete method, but in the 1960s I already fell behind, because Haefliger had done his excellent work. If I continued in this direction, I would be passive[ly following]. Should I go on passively, or should I liberate myself from the passive situation and search for a new direction?" (2004: 17).

Wu's publications during 1961–65 reflect this search. These short notes developing his earlier ideas or isolated remarks on other people's theorems did not have major influence in China or abroad, although his last publication before the Cultural Revolution, on algebraic varieties with singularities, was quite promising (Ke 2009: 87–89). He spent a lot of time teaching at the University of Science and Technology of China, founded by the Chinese Academy of Sciences to ameliorate the lack of high-quality graduates assigned to the Academy by the Higher Education Ministry (Hu and Shi 2002: 69–72; Zhang et al. 2008: 99–102). There was a also permanent tension between advocates of primarily academic mathematics, such as Hua Loo-Keng, and proponents of task-driven research, represented by Hua's main opponent, Communist Party member and deputy director Guan Zhaozhi 关肇直 (1919–82). Finally, just before the Cultural Revolution, research was interrupted by the "Socialist Education Movement" ("Four Cleanups," *Si qing* 四清; MacFarquhar 1997: 334–48), when the entire institute was sent, in two stages, to the countryside. Wu went with the second group in July 1965 and returned in early 1966 (Ke 2009: 89–90).

Wu Wen-Tsun came from a middle-class family, had studied abroad, and avoided politics. This placed him into the category of "bourgeois academic authorities" and made him a target of criticism during the first dramatic years of the Cultural Revolution (Ke 2009: 91–93). In 1966, many of his students wanted to withdraw from topology to more practical subjects (Zhongguo kexueyuan 1966). Although Wu did not suffer repeated denunciations or confinement like some of his colleagues, his home was searched, and he had to stop all mathematical activities, which were immediately denounced when discovered (Ke 2009; Lu 2010). The forced inactivity led Wu to read the entire corpus of Mao Zedong's writings, and he later said he found Mao's military strategy applicable for creating an independent Chinese mathematics. "You fight your way, I fight my way, the enemy advances, I retreat, the enemy retreats, I pursue.... I think it is the same with mathematics. The enemy in mathematics is nature" (interview with the author, 10 July 2010) (Fig. 1). "Chairman Mao explained how to turn a disadvantage into an advantage.... At the time I thought, Chinese mathematics is in a disadvantage, how to turn it into an advantage?" (Jiang 2003).

Fig. 1 Wu Wen-Tsun's interview with the author, 10 July 2010. Photograph by Li Wenlin

After the failed escape and death of Mao Zedong's assigned successor, Lin Biao, on 13 September 1971 and US President Richard Nixon's visit to China in February 1972, the country returned to some degree of normalcy and ended its international isolation (MacFarquhar and Schoenhals 2006: 337–57). China started to invite foreign mathematicians, whose visits stimulated research and advanced studies (Fig. 2). In April 1973, an American topology delegation (Donald C. Spencer, William Browder, and Franklin P. Peterson) visited Peking and brought with them notes from recent colloquia. Once again, Wu Wen-Tsun faced a crisis of research orientation and catching up with advanced research. He later recalled:

> The materials they gave me were hand-written, they were records from talks, with many strange symbols I had never seen before, and which could not be found in any books or journals. . . . So if I wanted to participate in this work, I would have to frequently meet foreign colleagues, frequently go to their seminars and conferences, which put me in a very passive position. I asked myself, how could I find my own research path, so that I'm not subject to foreign influences and can do research even in China? (Wu 2004: 17–18)

Wu tried to learn and develop the theory of minimal graded algebras recently created by Dennis Sullivan (b. 1941). In 1975, he was allowed to go to France to attend celebrations of his teacher Henri Cartan (MacLane 1980: 73) and met Sullivan at the Institut des Hautes Études Scientifiques. Wu's subsequent article (Wu 1976a) was positively reviewed by Jean-Michel Lemaire in *Mathematical Reviews* (MR0645387), which only underscored the importance of constant contact with advanced world research. But Wu's work continued to be disrupted by political

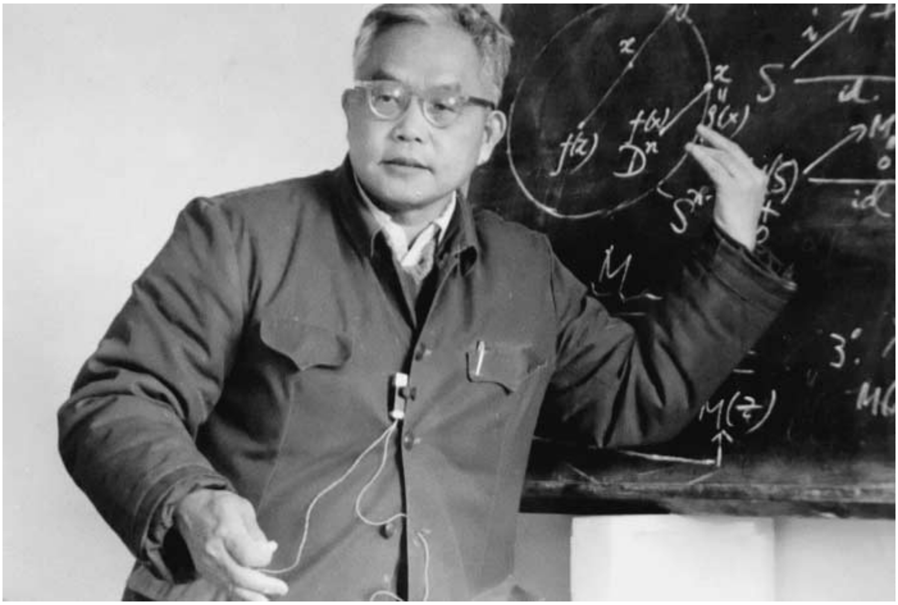


Fig. 2 Wu Wen-Tsun teaching differential geometry in 1972, to prepare his colleagues at the Institute of Mathematics for a visit of S. S. Chern (from Hu and Shi 2002: 4)

campaigns. The "anti-Lin Biao, anti-Confucius" campaign (Pi Lin Pi Kong yundong 批林批孔运动) in 1974 provided him with an unexpected answer to his search for direction.

3 "Making the Past Serve the Present": Wu Wen-Tsun's Decisive Turn to History

It is ironic that many Chinese intellectuals found their route to the history of their nation in the midst of a movement that wanted to do away with history. But in 1973 and 1974, the radicals around Mao Zedong's wife, Jiang Qing, mobilized Chinese history as a source of allegories against their rivals.

Lin Biao, now the chief villain and scapegoat for any social problems, was revealed as a secret admirer of Confucius. Mao was, on the other hand, indirectly compared with the First Emperor Qin Shihuang (259–10 BCE), and the Cultural Revolution with Qin's successful suppression of Confucian opposition to his "Legalist" government. Confucians came to represent die-hard reactionaries opposing the historically progressive victorious classes, represented by the Legalists. This interpretative framework was extended *ad absurdum* and used as a schematic analogy of all struggles between political and ideological lines, past and present. Radicals exploited these allegories for attacks against policies and individuals allegedly blocking or reversing the Cultural Revolution, especially the Premier Zhou Enlai (MacFarquhar and Schoenhals 2006: 358–72; Teiwes and Sun 2007: 118–58).

Although it has been suggested that the Pi Lin Pi Kong was designed "to demonstrate that China had revolutionary power, and revolutionary ideology, before anyone else" (Schram 1989: 181), explicitly nationalist themes were in fact largely absent, even though current foreign policy issues were part of the conflict between the radicals and the moderates (Teiwes and Sun 2007).

The campaign, however, became a channel for patriotism in the history of science and technology (Zhang 2003). Cultivation of patriotism had been an officially sanctioned goal of the history of science and technology in the People's Republic of China, enshrined in plans and policy documents (Xi and Guo 2011: 119–24). But this campaign had the added twist that scientific and technological achievements were attributed to Legalist or "popular" influences as proof of the historical superiority of Legalism and the reactionary nature and practical impotence of Confucianism.

These types of articles entered even the pages of China's scientific journals, recently reestablished or newly set up after the Cultural Revolution. Table 1 briefly summarizes those that were printed in the *Acta Mathematica Sinica* and *Mathematics in Practice and Theory*. The identity and affiliation of the first writer, "Shu Jin," is unclear; indeed, we cannot be sure whether both articles were written by the same author. The richness of their content and their style suggest that they were written by a pre-1966 historian of Chinese mathematics.

Members of the Institute of Mathematics, in contrast, only started to study ancient Chinese mathematics during this campaign, encouraged by the former deputy director Guan Zhaozhi, a long-time reliable Communist Party cadre, as Wu Wen-Tsun later explained:

> Initially I didn't know about and did not highly regard Chinese mathematics, I thought there was nothing to it. But later Guan Zhaozhi, whom I greatly admired, suggested that everyone should study some ancient mathematics. At that time there was a certain trend of revisiting the past [*fugu* 复古], Guan Zhaozhi's suggestion was relatively legal [*hefa* 合法, i.e., politically safe], because I could not do topology, I was criticized as soon as I started doing it. In the situation current at the time, no one had anything else to read, so I also had a look, initially just to know what was there. (Zhang et al. 2008: 105)

Guan probably did not personally contribute to the historical articles coming from the Institute of Mathematics. At least that was the case with "Gu Jinyong," actually Wu Wen-Tsun; the identity of the author was allegedly immediately clear to those close to him (Li 2001) and has been revealed in Wu 1982.[4] But Wu's ideas were profoundly influenced by long-term friendly contacts with Guan. Guan had favored the utilitarian orientation of the Great Leap Forward and had been a member of radical Red Guard organizations in 1966–69 (Wang 1999: 297). In the early 1970s, he advocated independent development of Chinese mathematics instead of following Western research (Wu Wen-Tsun, interview with the author, 10 July 2010).

Wu's take on the theme stood out sharply from the other articles on the history of Chinese mathematics. As can be seen from Table 1, his was the only article entirely occupied with the comparative position of Chinese mathematics, the only one not

---

[4] The other pseudonymous author, "Shu Qun," could be Yuan Xiangdong 袁向东 (b. 1942), who later specialized in the history of modern Chinese mathematics. Yuan's early interest was Zu Chongzhi's work on the *Calendar of Great Clarity* (*Da Ming Li* 大明历; interview with the author, 17 October 2008), which is precisely the focus of the Shu Qun article.

Table 1 Pi Lin Pi Kong historical articles in mathematical journals

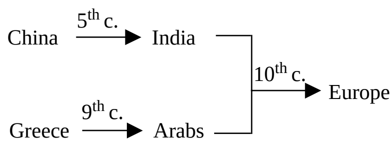
Journal	Title and Description	Author and Affiliation
AMS, 1974, no. 3	"Notes from studying materials for the history of Chinese mathematics—the struggle during the formation of the *Calendar of Great Clarity* and the mathematical achievements of Zu Chongzhi." Detailed, historically informed, confidently written, apparently from a long-time historian of Chinese mathematics; praises Zu's innovation against traditional calendar; relatively little about ideological struggle.	Shu Jin 舒进 (uncertain—pen name) (Shu Jin 1974a)
MPT, 1974, no. 4	"The great progressive scientist Zu Chongzhi." Detailed, but apparently by someone new to the field; illustrates the "two lines struggle" (Zu was a Legalist; later Confucianists did not understand his books and lost them), documents the advanced level of ancient Chinese science, to oppose "slavish crawling after the West"; extensive Marx-Lenin-Mao quotations.	Shu Qun 舒群, IMCAS (Shu Qun 1974)
AMS, 1974, no. 4	"Confucian reactionary thought obstructed and damaged the development of our ancient mathematics." Survey of the history of Chinese mathematics, historically rich but with more ideological rhetoric than the first article by the same pseudonym; no nationalist or pro-legalist themes.	Shu Jin 舒进 (uncertain—pen name) (Shu Jin 1974b)
MPT, 1975, no. 1	"Mathematical work of Shen Kuo—plus an attempt to discuss the stimulating role of Legalist thought on the development of science and technology in our country." Rich historical detail, emphasis on (the tenth-century polymath) Shen Kuo's political activities and interest in everyday experience of laboring people; few Marx-Lenin-Mao quotations; no nationalism.	Criticism Group of Operations Research Division, IMCAS (Zhongguo kexueyuan shuxue yanjiusuo yunchou shi da pipan zu 1975)
AMS, 1975, no. 1	"Great contributions of ancient Chinese mathematics to the world culture." Sophisticated analysis; list of references, including Western and Japanese sources; a few of Mao's nationalist quotations; Engels's "definition" of mathematics from the *Anti-Dühring*.	Gu Jinyong 顾今用 (pseudonym for Wu Wen-Tsun), IMCAS (Gu 1975)

MPT, 1975, no. 2	"A thorough criticism of the absurd theory that mathematics originated from the diagrams of He and Luo." A skilful combination of abundant historical information and derisive denunciations of Confucianism and "idealism"; few quotations (only Marx and Engels); list of references.	Li Di 李迪, Inner Mongolia Normal University (Li Di 1975)
AMS, 1975, no. 2	"The struggle between Confucians and Legalists and the development of our ancient mathematics." Many ideological quotations; little historical detail; no nationalism.	Third-Year Students of the Mathematics Department, Beijing Normal Institute (Beijing shifan xueyuan 1975)
AMS, 1975, no. 3	"About the history of Chinese mathematics." Polemical against (unnamed) earlier histories of Chinese mathematics; stress on social and political background, on the contributions of the masses against isolated "geniuses," on the relationship of mathematics to production, against mysticism and "idealism"; many ideological quotations, little historical detail; nationalism implicit (unproductive mathematics inspired by Western missionaries).	Wang Yao 王尧, Secondary School in Tianjin (Wang 1975)
MPT, 1975, no. 4	"Nine Chapters of Mathematical Techniques and the Legalist line." Focus on the political economy of Western Han as illustrated by practical problems in the *Nine Chapters*; historically inaccurate, ideological; no nationalism.	Theoretical Study Group of the Department of Mathematics, Beijing Normal University (Beijing shifan daxue 1975)
AMS, 1975, no. 4	"The formation of the 'Nine Chapters' and the struggle between the Confucians and the Legalists from pre-Qin to the Western Han." Historically detailed but heavily ideological argument in favor of an early date of compilation of the *Nine Chapters*; no nationalism.	Li Jimin 李继闵, Xi'an Municipal Normal College (Li Jimin 1975)
MPT, 1976, no. 4	"An outstanding medieval mathematician of our country—Li Ye." Some historical detail but mostly ideological, Li Ye as a critic of Confucian thought; criticism of academic research isolated from social concerns; no nationalism.	Wu Yubin 吴裕宾 and Chen Xinghua 陈兴华, Yangzhou Normal Institute (Wu and Chen 1976)

Abbreviations: *AMS*, *Acta Mathematica Sinica* (*Shuxue xuebao*); *MPT*, *Mathematics in Practice and Theory* (*Shuxue de shijian yu renshi*).

mentioning Confucian and Legalist ideology, and one of very few using standard scientific apparatuses of references and attributed quotations. Wu took history much more seriously than did most of the other authors.

The pseudonym Gu Jinyong 顾今用 was a thinly veiled pun on the slogan "make the past serve the present" (*gu wei jin yong* 古为今用). It was not intended to hide the author's identity (Wu Wen-Tsun, interview with the author, 10 July 2010). The central thesis of the article is the relevance of ancient Chinese mathematics to world mathematics, as expressed in the title: "Great Contribution of Ancient Chinese Mathematics to World Culture": "The development of modern mathematics up to the present day has mainly relied on Chinese mathematics and not on Greek mathematics; it was Chinese mathematics and not Greek mathematics which most importantly decided the direction of historical developments of mathematics" (Gu 1975: 23). This was supplemented by the following conjecture of a Chinese influence on modern mathematics:



Priority claims for Chinese discoveries of the decimal notation, negative numbers and certain algebraic techniques had been raised before by historians of Chinese mathematics. Wu's article depended on such earlier assertions, especially in Qian 1964 and Needham and Wang 1959, but he went beyond that to argue that the transmitted elements are central components of modern mathematics. For Wu, the relevance of ancient Chinese mathematics was demonstrated by the indispensable role and routine use of the Chinese inventions in many mathematical activities, whether or not these inventions were actually transmitted to the Hindus, al-Khwārizmī, and eventually Descartes. Wu hoped that some such influence could one day be shown (Wu 1984b) but sometimes acknowledged a possibility of independent invention (e.g., of al-Khwārizmī's algebra, see Wu 2003: 22).

The Gu Jinyong article was written in late 1974. In 1975, Wu returned to algebraic topology but continued to study ancient Chinese mathematics, and even gave a talk on it at the French Institut des Hautes Études Scientifiques (Cheng 1994: 383). In early 1976, another movement—against Deng Xiaoping—started, and abstract mathematics was again problematic. Ancient Chinese mathematics once more offered safety. This time the work plan for the Institute of Mathematics was more specific:

> Uphold the principle of independence and self-reliance, oppose the philosophy of slavishly following the Westerners and prostrating before them, walk our own road of developing science and technology.... The laboring masses of workers and peasants of our country have, in the long course of production practice, accumulated plentiful experience. Mathematical inventions and discoveries were not small in number. Some await theoretical summarizing and elevation, providing an important source of development for our mathematical theories

> and methods. We must accord them the necessary importance. (Zhongguo kexueyuan shuxue yanjiusuo dang de lingdao xiao zu 1976)

Although there is no evidence who wrote this passage, it was not a mere compilation of directives from above. The principle of independence and self-reliance (*duli zizhu, zi li gengsheng* 独立自主，自力更生) was an important part of Mao Zedong's thought but not a point in the renewed political struggle of the anti-Deng campaign. It is therefore plausible that this paragraph was inserted "from below," most probably by Guan Zhaozhi at Wu's suggestion.

By 1976, Wu Wen-Tsun's strategy of mathematical survival had been formed. He decided to claim independence and self-reliance by mobilizing ancient Chinese mathematics. At the beginning, it was scarcely more than a rhetorical device to shield his topological research from political criticism. In the article quoted in the introduction to this paper (Wu 1976b), Wu portrayed his work on the Sullivan theory ("*I**-functor" or "*I**-measure") as an outgrowth of his study of Marxism-Leninism and of ancient Chinese mathematics:

> In the ancient mathematics of our country, the emergence and development of algebra was permanently linked to the development of geometry. We have absorbed this thought, and received inspiration from the method of dealing with volumes of solids in the *Shang gong* chapter and elsewhere in the classical mathematical book *Nine Chapters on Mathematical Art* [*Jiu zhang suan shu* 九章算术]. We have introduced the concept of "computability" of a functor or measure, and used it to systematically investigate the newly introduced [*I**-] measure. (15)

Was this a sincere account of Wu's creative process? If so, he did not find it convincing later, as this claim has never been repeated in Wu's praises of the intimate connection between algebra and geometry in ancient Chinese mathematics. The main reason could be that his work on the *I**-functor, although reviewed favorably by his peers, was not seen as a major breakthrough. As soon as Wu found a new passion for algorithmic or, as he called it, "mechanized" mathematics, he could claim Chinese ancestry more plausibly than in algebraic topology. He continued to do so even when rhetorical shielding was no longer necessary.

4 Tradition Serving Modernization: Wu Wen-Tsun's Method of "Mechanization" and His Historical Writings after 1976

One of the last acts of Premier Zhou Enlai (1898–1976) was the reiteration of the policy of Four Modernizations (of agriculture, industry, national defense, and science) at the National People's Congress of 1975, with the wish that China would become a modern socialist country before the end of the twentieth century. This theme came back into prominence after the fall of the Gang of Four in October 1976. Research that could be explicitly linked to it was considered especially promising.

One attractive area on the border of pure and applied mathematics related to modernization was the development of computers. Related research was mostly concentrated in the Institute of Mathematics or the Institute of Computation Science, which resided in the same building. In 1976, Wu Wen-Tsun joined Lu Qikeng 陆启铿 (b. 1927), a longtime colleague, in exploratory work on the applications of computers to mathematical reasoning, using the computer built by the IMCAS Computer Factory. Eventually both found the available hardware too basic for the task, and Lu Qikeng gave up this agenda (Lu Qikeng, interview with the author, 13 October 2008).[5]

Wu instead looked for a method that could be first tried by hand. He focused on theorems in elementary geometry, going back to his teaching years in wartime Shanghai. But instead of synthetic Euclidean demonstrations, he translated a theorem into a set of polynomial equations and wanted to check whether the premises and conclusions were consistent. During the 1977 Chinese New Year holiday, he achieved first successes with a set of algorithms, opaquely described in Wu 1977. (For an accessible introduction to Wu's method, see Chou 1988.) He observed that there was a Chinese precedent for them:

> The algorithm we use for mechanical proofs of theorems in elementary geometry involves mainly some applied techniques for polynomials, such as arithmetic operations and simple eliminations of unknowns. It should be pointed out that these were all created by Chinese mathematicians in the 12–14 century Song and Yuan period, and already reached considerable development then. The work of Qian Baocong can be consulted for detailed introduction. (Wu 1977: 515)

At the same time, he developed a grand vision of "mechanization of mathematics," a term created by the Harvard-based mathematical logician Hao Wang 王浩 (1921–95) after his computer proof of Bertrand Russell and Alfred North Whitehead's *Principia Mathematica* (Wang 1960). Wang had visited China in 1972 and 1973–74 and met Wu Wen-Tsun. Wu suggested that mechanization runs through the entire history of mathematics as a complementary tendency to axiomatization (Wu 1978a: 373–74). Axiomatization was Greek; mechanization, it seemed to Wu, was totally Chinese. All those "great contributions of our ancient mathematics to world culture," as he had written about in Gu 1975, were making mathematics more mechanical, to the point where it could be taught to schoolchildren and engineers. This was a feature of "Oriental mathematics" observed, with some contempt, by Dirk Struik (1948: 31–32). Wu wanted to turn this disadvantage into an advantage.

At the same time, Wu called for the establishment of new research directions not derivative of foreign mathematics:

> Mathematical workers of our country should ... come up with our own viewpoints and methods, establish a couple of mathematical schools with our country's characteristics, produce a series of internationally influential mathematicians, in order to make a sizable contribution to the solution of mathematical problems posed by socialist construction, and to the Four Modernizations, independently and from our own initiative. (Wu 1978b: 21)

[5] Wu Wen-Tsun has repeated since about 2001 that he understood the power of computers during his work in the First Beijing Wireless Telegraphy Factory (Beijing wuxiandian yi chang 北京无线电一厂), where he was dispatched to "engage in labor" in 1970 and 1971 (Hu and Shi 2002: 76, 138; Ke 2009: 93–94). According to a contemporary report, the "Telecommunications Factory in Peking" produced some simple, single-purpose production automation devices (Cheatham et al. 1973).

The emphasis on national independence was linked with a more universal theme. Wu believed that with the development of computers, the laborious, patchy style of axiomatic-deductive reasoning would be overcome by algorithmic, mechanical methods whenever possible. “Proofs of some theorems or categories of theorems can avoid the common, elegant but mysterious and therefore difficult mode, and use the repetitive but routine and therefore easy mode.... Computers can thus liberate people from the mental labour of certain logical inferences, and enable mathematicians to use their intelligence on truly innovative work” (ibid.: 20). This had a national and strategic significance: “Our country has, in the revolutionary mechanization of physical labour, fallen behind several countries that had already become highly-developed, and in this present revolutionary mechanization of mental labour, we definitely must not again fall into the old track. We have to try hard to move ahead of all countries of the world.” (Wu 1978a: 374).

These were no mere disinterested deliberations—Wu wrote these articles at a time when he was also applying for substantial financial and organizational support to buy a workable computer and finally try his method on it, rather than by hand (Ke 2009: 128). Import of foreign technology to, paradoxically, increase independence and self-reliance had to be justified by sophisticated arguments. “Mechanization of mental labor” and the danger of falling behind performed very well and became parts of Wu’s standard repertoire—always combined with the assurance that ancient Chinese mathematics, which used to be ahead of the world in mechanization, can serve as a guide to the same privileged position (see Wu 2002).

Wu perhaps saw a positive example in the works of the computer scientist Donald Knuth. He studied Knuth’s textbook *The Art of Computer Programming* (vols. 1–3, 1968–1973), consisting of commented algorithms, similarly to ancient Chinese mathematical classics consisting of problem-solving methods. Knuth also published an article on ancient Babylonian algorithms, writing that “one of the ways to help make computer science respectable is to show that it is deeply rooted in history, not just a short-lived phenomenon” (Knuth 1972: 671). The article was cited by Wu’s younger colleague Li Wenlin in the early 1980s (Li and Yuan 1982), suggesting that Wu was aware of it, too. Wu proceeded in the opposite direction, making ancient Chinese mathematics respectable by showing what can be rooted in it. He emphasized that although his method had its forerunners in Western mathematics, it was not directly influenced by them:

> We set out the question and came up with a method of solution under inspiration from Chinese ancient algebra. The reason is actually easy to understand: Chinese ancient mathematics was basically a mechanized mathematics.... The work of the present author on mechanization of mathematics is precisely a product of inspiration from these ideas and results, it is a direct continuation of our mathematics from the *Nine Chapters* up to the Song and Yuan periods. (Wu 1980: 43–44)

Was Wu only making an ex-post link between his method and ancient Chinese mathematics, or did this inspiration really occur? The earliest precise explanation of what he meant is quoted in Li (2001: 59): “My method of solving equations is basically derived from Zhu Shijie. He used elimination, eliminated variables one by one, and this provided me with a basic model for the method. Of course, Zhu Shijie had no theory, it was very crude, only calculations. I developed it and put it on a truly modern mathematical ground of algebraic geometry." This sounds plausible. The central algebraic technique applied in Wu's method—polynomial elimination—is indeed also central in the *Jade Mirror of the Four Unknowns* (*Si yuan yu jian* 四元玉鉴), written by Zhu Shijie and published in 1303. The technique was described in precise and easily comprehensible terms in (Qian 1964), which Wu knew very well by the time he started working on his mechanization method (Hudecek forthcoming).

It is also significant that the major Western inspiration of Wu's work from J. F. Ritt's theory of algebraic differential equations (Ritt 1950), which is now acknowledged in the name "Wu-Ritt method," seems to have occurred later (Li 1989: 364). In his first article on mechanization of proofs (Wu 1977), Wu observed that Ritt's concept of characteristic sets was "intimately related" but did not use Ritt's techniques either in examples or in proofs. Ritt's theory, which included polynomial elimination by the same technique used by Zhu Shijie, was only fully used in Wu 1984a.

The question of inspiration will probably remain unsettled, but it will always be important. Wu stressed his inspiration in the style of ancient Chinese mathematics rather than in a single technique—in its mechanical, algorithmic, constructive character, orientation on problem and equation solving, and so forth (Wu 1987). But these features are only his abstractions, based on modern mathematical ideas. A concrete inspiration in a specific technique would be a more powerful argument for the modern relevance of ancient Chinese mathematics. But even if the inspiration did occur, its value is problematic if it can be provided just as well by other sources. Here the problem-oriented style of presentation of ancient Chinese texts could perhaps be seen as their advantage over theoretical works of Western mathematics. Wu also sometimes stressed higher efficiency of Chinese algorithms over Western ones (ibid.).

5 From Frustration to Historicism: Genesis of Cultural Nationalism

On its own, Wu Wen-Tsun's story might look like just another curiosity of the history of modern Chinese mathematics. One thinks of Hua Loo-Keng's popularization of operations research among the peasants and workers (Wang 1999: 278–84, 302–15) or the cruel experiences of Chen Jingrun (Wang and Li 1998) and many others. I want to argue here that Wu is a special representative of a more universal story of the formation of cultural nationalism and its intimate connection with historicism.

"Cultural nationalism" was a category created by the political scientist Hans Kohn (1945) for the often very emotional identification with nations defined by a shared culture, rather than by existing state boundaries (as "political nationalism" does). The well-documented disruptive effects of cultural nationalism, especially of its associated resentment and defiance of status quo, motivated a search for theoretical explanations of its omnipresence and continuous generation and reproduction in the modern world.

Ernest Gellner (1964: 147–78) presented an influential answer based on modernization theory, which can be summarized as follows. Survival in the modern world requires that every member of a polity share a universal language and cultural idiom and suppress the traits of his or her local culture. Because modernization proceeds unevenly across the globe and within large states, some cultures monopolize higher status, and the rest are seen as backward. But modern age also brings social mobility and universal aspirations. Gellner's theory predicts that when these aspirations are substantially frustrated for elites of the disadvantaged cultures, they will transform their local culture into a "rival nation" of their own (165). Because "intellectuals are not substitutable across borders," these breakaway elites have a prospect of rapid social mobility if their movement succeeds. They try to mobilize the equally disadvantaged proletariat by appeals to their shared cultural traits, elaborately constructed by ethnographic and historical research. "Nationalism is not the awakening of nations to self-consciousness: it invents nations where they do not exist—but it does need some pre-existing differentiating marks to work on" (168).

There is much in this theory that resonates with Wu Wen-Tsun's story, and we can attempt to adapt Gellner's categories to describe a situation where the setup of a "rival nation" also involves a rival national mathematics. One major adjustment must reflect the fact that the Chinese nation *did* already exist, had its nation-state, and was thus defined politically as well as culturally. Wu's frustration was caused by the political aspects of his Chineseness: restricted access to international mathematics and limited time and freedom of research were imposed by his countrymen, not by external cultural discrimination. But he decided to accept it by living in China, and when the cultural aspect of Chinese identity was accidentally highlighted during the Pi Lin Pi Kong campaign, Wu seized it and tried to build an independent Chinese mathematical school on the cultural distinctions he had found in ancient Chinese mathematics. Although his focus on culture was a conscious evasion of politics, the factor that really mattered, his desire for independence, was genuine and produced by this redefined "uneven development."

Here we can add another nuance: in the political sense, Chinese mathematics was of course independent. Wu and Hua, among others, were its revered leaders, albeit harassed by the Cultural Revolution. They were already shielded from direct foreign competition for their *positions* (securing of which can be an incentive for nationalism in Gellner's theory). "Nationalization" of Chinese mathematics has to be understood in a different sense—as creating a branch of world mathematics with Chinese characteristics, where Chinese mathematicians would be protected, by their privileged access to the foundation of the discipline, from the competition for their *results*.

As long as catching up in direct competition appeared hopeless, this form of mathematical cultural nationalism made good sense. Wu carried out all the nation-building work. He identified the defining positive features of ancient Chinese mathematics: mechanization, constructiveness, computability, and solution of practical problems (Wu 1988a). They were clearly chosen for their contrast with modern mathematics and for their positive value in Wu's philosophy of mathematics but were also undeniably derived from careful (albeit selective) historical studies. In Gellner's terms, Wu wanted to mobilize the mathematical "proletariat"—prospective students. One could say that he tried to do it by drawing a greater-than-life portrait of ancient Chinese mathematics, abundant in qualities that modern mathematics lacked.

The crucial element of Wu's nation building was of course the link between ancient Chinese mathematics and the mechanization of proofs. It was the main argument for his claim that ancient Chinese mathematics indeed offered useful, surprisingly modern ideas, that the past *can* serve the present. Gellner's theory does not have categories for this and other forms of cultural nationalist relations to history (hilariously parodied in Gellner 1983: 58–61).

This dimension of nationalism was analyzed more seriously by Anthony D. Smith. Smith in fact focused on the prenationalist category of *ethnie* and considered modern nationalism only a particular form of ethnic revivals recurring throughout history (1981). In Smith's theory, modern ethnic revivals—in other words, nationalism—are characterized by their historicism, which he understood as the predilection "to establish, through detailed historical investigations, the origins, growth and purpose of particular entities" (1981: 88), providing "a framework of meaning to their distinct characteristics" (90). The origins of historicism lie in the Enlightenment and its opposition to irrational religious or customary authority. Historicism replaces them with evolutionary, rational tales of the formation of the present.

Smith recognized three "routes to ethnic historicism": neotraditionalist, assimilationist, and reformist (1981: 96–107). For the neotraditionalists, who "accept the technical achievements and some of the methods of western science and rationalism without any of its underlying assumptions" (97), history is a source of explanations of the "decline from past grandeur and present misfortunes," intended to strengthen the shaken national pride. For the assimilationists, who "embrace with an almost messianic fervour" modern society, historicism provides the understanding of their communities necessary to establish a local version of the "rational, progressive and scientific state," after their initial hopes to assimilate themselves in the already existing modern states have failed (99–102). The reformists, finally, want to find a compromise between modern rationality and traditional authority and for this reason "look back to those ages and periods of the community in which religion was pure and the community itself was great . . . to salvage the true, the underlying, the pure" (103).

As Smith himself emphasized, the three positions have fluid boundaries. Individuals often switch among them in the course of their lives. But these three positions basically characterize all versions of ethnic historicisms and can be seen recurring over several generations within one country, as in the thoroughly studied case of Ireland (Hutchinson 1987).

To apply this theory to Wu's historicism, we must again make some adjustments. Smith's focus on the "ethnic" would be confusing in this case, because Wu never talks about the Han or even about ancestors. More important, Wu does not need to reconcile science and religion, or traditional authority and reason. This battle was decisively won (for the time being?) by science many decades earlier. But Wu wants to find a *compromise* between ancient Chinese and modern mathematics and thus becomes a "reformist" in Smith's classification.[6] He tried to salvage the pure and true qualities of ancient Chinese mathematics by focusing on its most celebrated texts and most successful periods and by applying a strict methodology of reconstructions of ancient reasoning, forbidding tools from Greek or modern mathematics (Wu 1981). His explicit calls for its revival on the basis of the reconstructed essential qualities (Wu 1988b) are typical for a reformist position. Finally, Wu's method of mechanization, presented

[6] Neotraditionalist historicism in Chinese mathematics could be identified with the eighteenth-century belief in the "Chinese origins of Western learning." Assimilationist historicism has dominated the last sixty years.

as a successful combination of traditional and modern elements, is a project every reformist hopes to achieve by their historicist studies.

To summarize, Wu Wen-Tsun's emphasis on the cultural distinctiveness of Chinese mathematics is motivated by the desire to achieve a certain form of (mathematical) independence and protection against "uneven development." Gellner's theory applies here, with the important addition that the "uneven development" in this case was caused more by internal Chinese factors than by the inevitable logic of modernization. On the other hand, the specific form of Wu's use of history is made meaningful by classifying him as a (nonreligious) reformist according to Anthony D. Smith. Wu Wen-Tsun tried to find a compromise between his Chinese and mathematical identity, which gave rise to his reformist historicism.

All of this, of course, happened in an environment that was crudely nationalistic most of the time. Wu's biography includes life in the Japanese-occupied Shanghai, a return to China at the height of the Korean War, denunciations of imperialism, "socialist imperialism," and the "slavish crawling after the West." It is no surprise that Wu was a fervent patriot and nationalist in the sense of defending his nation and its self-confidence. It is the fact that his nationalism reached the realm of—almost—pure reason that is especially remarkable.

6 Epilogue

Wu Wen-Tsun's mechanization experiments initially did not generate much interest. He was protected by Guan Zhaozhi in the Institute of System Science, which split from the Institute of Mathematics in 1979, from doubts raised by colleagues who preferred a standard Western path to mechanical reasoning (Ke 2009: 126). He had first graduate students only in 1983 (Hu and Shi 2002: 124). By that time, his method was brought to the attention of US specialists in computer proofs at the University of Texas by Chou Shang-Ching (Zhou Xianqing 周咸青), who started a doctorate there in 1982. Chou had listened to Wu's lectures on David Hilbert's *Foundations of Geometry* (*Grundlagen der Geometrie*) in 1978, where Wu mentioned his experiments. Chou was able to reconstruct the method from his notes and Wu's articles and popularized it in the US automated reasoning community (Chou 2010).

The period 1985–90 witnessed a surge of enthusiasm for computer proofs based on Wu's method in China and abroad (Wang et al. 2010). Although this dispelled the earlier doubts about the viability of Wu's method, it also brought a proliferation of alternative approaches. Wu's students were now keeping track of developments in their field around the world (2010: 224) and had no time for ancient Chinese mathematics.

This did not limit Wu's success. In 1990, Wu persuaded Chinese funding bodies to establish a Center for Mechanization of Mathematics in the Institute of System Science (Hu and Shi 2002: 158–60), and he started receiving various awards, prizes, and honors: mathematical prize and membership of the Third World Academy of Sciences in 1992, Herbrand Award for Automated Reasoning in 1997, and the first Highest National Award for Science and Technology in 2001, to name but a few most important ones (170–85). His project "Machine Proofs and Their Applications" became one of the key government-funded research projects in 1992, expanded into a "Forum for

Mathematics Mechanization and Automated Reasoning" in 1998 (161–62). He also served as president of the Chinese Mathematical Society (1984–87), head of the Academic Department of Mathematics, Physics and Chemistry of the Chinese Academy of Sciences (1992–94), and chairman of the International Congress of Mathematicians in Beijing (2002) (207).

Wu also received some recognition for his historical work. He was invited to present a survey of recent studies of the history of Chinese mathematics at the International Congress of Mathematicians in Berkeley (Wu 1986), where he avoided the nationalist arguments but kept his general ideas about the main features of ancient Chinese mathematics. His methodology of reconstructions of ancient proofs (Wu 1981) was especially influential, and the attention to the specific style, rather than just content, of Chinese mathematics has been called the "Wu paradigm" (Qu 2002), because it opened new perspectives where the content had already been researched. His conclusions were, however, not so universally accepted (Hudecek 2008: 43–48).

Part of Wu's status in the historical community comes from his active support of the history of Chinese mathematics. He set up a Mathematics and Astronomy Silk Road Fund, using 1 million yuan, 20 percent of the cash prize he received in 2001 with the Highest National Award for Science and Technology. The fund was to finance investigation of intercultural transmission of mathematics, with the clear hope that new evidence of Chinese influence on other Asian countries will eventually be found (Li Wenlin 2010). Chinese historians of mathematics have often invited Wu to act as (honorary) editor of conference volumes and collective works, including the *Great Series on the History of Chinese Mathematics* (*Zhongguo shuxue shi da xi* 中国数学史大系, 1998–2000). The prefaces to these works were an important dissemination channel for Wu Wen-Tsun's ideas.

Wu has not backed off from his beliefs about the modern relevance of ancient Chinese mathematics, but they have not gained much support in more than thirty years since he first formulated them. His method of mechanization was successful, and a Chinese school of computer mathematics did arise around it, but there has been no further inspiration from ancient Chinese mathematics. Similarly, his philosophical approach and the questions he posed about ancient Chinese mathematics attracted new students to its history, but his specific views were not nearly as successful. It seems that once catching up in direct competition becomes possible, nationalist historicism loses its appeal.

References

Amelung, Iwo (2003). Die Vier großen Erfindungen: Selbstzweifel und Selbstbestätigung in der chinesischen Wissenschafts- und Technikgeschichtsschreibung. In *Selbstbehauptungsdiskurse in Asien: China—Japan—Korea*, edited by Iwo Amelung, Matthias Koch, Joachim Kurtz, Eun-Jung Lee, and Sven Saaler, 243–74. Munich: Judicium.

Beijing shifan daxue shuxue xi lilun xuexi xiao zu 北京师范大学数学系理论学习小组 (Theoretical Study Group of the Department of Mathematics of Beijing Normal University) (1975). "Jiu zhang suan shu" he fa jia luxian 《九章算术》和法家路线 (Nine Chapters on Mathematical Techniques and the Legalist Line). *Shuxue de shijian yu renshi* 数学的实践与认识 (*Mathematics in Practice and Theory*) 5, no. 4: 1–6.

Beijing shifan xueyuan shuxue xi san nianji gong nong bing xueyuan 北京师范学院数学系三年级工农兵学员 (Third Year Worker-Peasant-Soldier Students of the Mathematics Department of Beijing Normal

Institute) (1975). Ru fa douzheng yu wo guo gudai shuxue de fazhan 儒法斗争与我国古代数学的发展 (The Struggle between Confucians and Legalists and the Development of Ancient Mathematics of Our Country). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 18, no. 2: 81–85.

Cheatham, Thomas E., Jr., Wesley A. Clark, Anatol W. Holt, Severo M. Ornstein, Alan J. Perlis, and Herbert A. Simon (1973). Computing in China: A Travel Report. *Science* 182, no. 4108: 134–40.

Cheng Minde 程民德, ed. (1994). *Zhongguo xiandai shuxuejia zhuan* 中国现代数学家传 (*Biographies of Modern Chinese Mathematicians*). Vol. 1. Nanjing: Jiangsu jiaoyu chubanshe.

Chou Shang-ching (1988). *Mechanical Geometry Theorem Proving*. Dordrecht: Reidel.

Chou Shang-ching 周咸青 (Zhou Xianqing) (2010). Wu Wenjun xiansheng he jihe dingli zhengming 吴文俊先生与几何定理证明 (Wu Wen-Tsun and Geometric Theorem Proving). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 *(Wu Wen-Tsun and Chinese Mathematics)*, edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 215–20. Singapore: World Scientific.

Dieudonné, Jean A. (1989). *A History of Algebraic and Differential Topology, 1900–1960*. Basel: Birkhäuser.

Gan Danyan 干丹岩 (2010). Huiyi he ganhuai 回忆和感怀 (Memories and Gratefulness). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊对拓扑学的伟大贡献 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 129–34. Singapore: World Scientific.

Gellner, Ernest (1964). *Thought and Change*. London: Weidenfeld and Nicholson.

Gellner, Ernest (1983). *Nations and Nationalism*. Oxford: Blackwell.

Gu Jinyong 顾今用 (Wu Wen-Tsun 吴文俊) (1975). Zhongguo gudai shuxue dui shijie wenha de weida gongxian 中国古代数学对世界文化的伟大贡献 (Great Contributions of Ancient Chinese Mathematics to World Culture). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 18, no. 1: 18–23.

Haefliger, André (1961). Differentiable Imbeddings. *Bulletin of the American Mathematical Society* 67, no. 1: 109–12.

Hu Zuoxuan 胡作玄, and Shi He 石赫 (2002). *Wu Wenjun zhi lu* 吴文俊之路 (*Wu Wen-Tsun's Road*). Beijing: Science Press.

Hua Loo-Keng 华罗庚 (1956). *Cong Yang Hui sanjiao tan qi* 从杨辉三角谈起 (*Starting from Yang Hui's Triangle*). Beijing: Renmin jiaoyu chubanshe.

Hudecek, Jiri (2008). Historiography and Practice of Mathematics: Wu Wenjun's Historical Claims and His Method. M.Phil. diss., University of Cambridge.

Hudecek, Jiri (forthcoming). Zhu Shijie's Method of "Four Unknowns" as Inspiration for Wu Wenjun. In *Multi-cultural Perspectives of the History of Science and Technology in China: Proceedings of the 12th International Conference on the History of Science in China*. Beijing: Science Press.

Hutchinson, John (1987). *The Dynamics of Cultural Nationalism*. London: Allen and Unwin.

Jiang Yan 姜岩 (2003). Ganshou da shi fengcai—Ji Wu Wenjun yuanshi 感受大师风采—记吴文俊院士 (Experiencing Master's Charisma). *Keji xinxi* 科技信息. (*Science and Technology Information*) 2003 (10).

Ke Linjuan 柯琳娟 (2009). *Wu Wenjun zhuan: Rang shuxue huigui Zhongguo* 吴文俊传：让数学回归中国 (*Biography of Wu Wen-Tsun: Let Mathematics Return to China*). Nanjing: Jiangsu renmin chubanshe.

Knuth, Donald E. (1972). Ancient Babylonian Algorithms. *Communications of the ACM* 15, no. 7: 671–77.

Kohn, Hans (1945). *The Idea of Nationalism*. New York: Macmillan.

Lehto, Olli (1998). *Mathematics without Borders: A History of the International Mathematical Union*. New York: Springer.

Li, Banghe 李邦河 (1989). Wu Wen-Tsun—An Outstanding Mathematician. *Acta Mathematica Scientia* 9, no. 4: 361–65.

Li, Banghe 李邦河 (2010). Wu Wenjun dui tuopuxue de weida gongxian 吴文俊对拓扑学的伟大贡献 (Wu Wen-Tsun's Great Contributions to Topology). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 3–7. Singapore: World Scientific.

Li Di 李迪 (1975). Chedi pipan guanyu shuxue qiyuan yu "He tu Luo shu" de miulun 彻底批判关于数学起源于"河图洛书"的谬论 (A Thorough Criticism of the Absurd Theory That Mathematics Originated from the Diagrams of He and Luo). *Shuxue de shijian yu renshi* 数学的实践与认识 (*Mathematics in Practice and Theory*) 5, no. 2: 11–15.

Li Jimin 李继闵 (1975). Jiu Zhang Suan Shu de xingcheng yu xian Qin zhi Xi Han shiqi de ru fa douzheng 《九章算术》的形成与先秦至西汉的儒法斗争 (The Formation of the "Nine Chapters" and the Struggle between the Confucians and the Legalists from Pre-Qin to the Western Han). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 18, no. 4: 223–30.

Li Wenlin 李文林 and Yuan Xiandong 袁向东 (1982). Zhongguo gudai buding fenxi ruogan wenti tantao 中国古代不定分析若干问题探讨 (On Some Problems about Indeterminate Analysis in Ancient and Medieval China). *Keji shi wen ji* 科技史文集 (*Papers in History of Science and Technology*) 8: 106–22.

Li Wenlin 李文林 (2001). Gu wei jin yong de dianfan—Wu Wenjun jiaoshou de shuxue shi yanjiu 古为今用的典范—吴文俊教授的数学史研究 (A Paragon of Using the Past for the Present—Professor Wu Wen-Tsun's Studies of the History of Mathematics). In *Shuxue yu shuxue jixiehua* 数学与数学机械化 (*Mathematics and Mechanization of Mathematics*), edited by Lin Dongyue 林东岳, Li Wenlin 李文林, and Yu Yanlin 虞言林, 49–60. Jinan: Shandong jiaoyu chubanshe.

Li Wenlin 李文林 (2010). Gu wei jin yong, zizhu chuangxin de dianfan—Wu Wenjun yuanshi de shuxue shi yanjiu 古为今用、自主创新的典范—吴文俊院士的数学史研究 (A Paragon of Using the Past for the Present and of Independent Innovation—Academician Wu Wen-Tsun's Studies of the History of Mathematics). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 27–41. Singapore: World Scientific.

Lu Qikeng 陆启铿 (2010). Wu Wen-Tsun xiansheng de xueshu sixiang dui wo de yingxiang 吴文俊先生的学术思想对我的影响 (The Influence on Me of Wu Wen-Tsun's Academic Thought). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 49–54. Singapore: World Scientific.

MacFarquhar, Roderick (1997). *The Coming of the Cataclysm, 1961–1966* (vol. 3 of *Origins of the Cultural Revolution*). Oxford: Royal Institute of International Affairs.

MacFarquhar, Roderick, and Michael Schoenhals (2006). *Mao's Last Revolution*. Cambridge, MA: Belknap Press.

MacLane, Saunders (1980). Pure and Applied Mathematics. In *Science in Contemporary China*, edited by Leo A. Orleans, 53–84. Stanford: Stanford University Press.

Milnor, John, and James Stasheff (1974). *Characteristic Classes*. Princeton, NJ: Princeton University Press.

Needham, Joseph, and Wang Ling (1959). *Mathematics and the Sciences of the Heaven and the Earth* (vol. 3 of *Science and Civilisation in China)*. Cambridge: Cambridge University Press.

Qian Baocong 钱宝琮 (1964). *Zhongguo shuxue shi* 中国数学史 (*History of Chinese Mathematics*). Beijing: Kexue Chubanshe.

Qu Anjing 曲安京 (2002). The Third Approach to the History of Mathematics in China. In *Proceedings of the International Congress of Mathematicians: Beijing 2002, August 20–28*, edited by Daqian Li, 947–58. Beijing: Science Press.

Ritt, J. F. (1950). *Differential Algebra*. New York: American Mathematical Society.

Schram, Stuart (1989). *The Thought of Mao Tse-Tung*. Cambridge: Cambridge University Press.

Shu Jin 舒进 (1974a). Xuexi Zhongguo shuxue shi ziliao zhaji—"Da Ming li" chansheng de douzheng yu Zu Chongzhi de shuxue chengjiu 学习中国数学史资料札记—《大明历》产生时的斗争与祖冲之的数学成就 (Notes from Studying Materials for the History of Chinese Mathematics—The Struggle during the Formation of the Calendar of Great Clarity and the Mathematical Achievements of Zu Chongzhi). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 17, no. 3: 153–55.

Shu Jin 舒进 (1974b). Rujia de fandong sixiang dui wo guo gudai shuxue de fazhan qi zhe zu'ai he pohuai de zuoyong 儒家的反动思想对我国古代数学的发展起着阻碍和破坏的作用 (Confucian Reactionary Thought Obstructed and Damaged the Development of Our Ancient Mathematics). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 17, no. 4: 227–33.

Shu Qun 舒群 (1974). Weida de jinbu kexuejia Zu Chongzhi. 伟大进步科学家祖冲之 (The Great Progressive Scientist Zu Chongzhi). *Shuxue de shijian yu renshi* 数学的实践与认识 (*Mathematics in Practice and Theory*) 3, no. 4: 1–6.

Smith, Anthony D. (1981). *The Ethnic Revival*. Cambridge: Cambridge University Press.

Ssu-ma, Ch'ien (Sima Qian), and William H. Nienhauser Jr., eds. (1994). *The Memoirs of Pre-Han China* (vol. 7 of *The Grand Scribe's Records*). Bloomington: Indiana University Press.

Stone, Marshall H. (1961). Mathematics, 1949–1960. In *Sciences in Communist China*, edited by Sidney H. Gould, 617–30. Washington, DC: American Association for the Advancement of Science.

Struik, Dirk J. (1948). *A Concise History of Mathematics*. New York: Dover.

Sun Yifeng 孙以丰 (2010). Huiyi yi ge tuopu xiao zu de er san shi 回忆一个拓扑小组的二三事 (Remembering a Few Stories from a Topology Group). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 123–26. Singapore: World Scientific.

Teiwes, Frederick C., and Warren Sun (2007). *The End of the Maoist Era: Chinese Politics during the Twilight of the Cultural Revolution, 1972–1976*. Armonk, NY: Sharpe.

Thom, René (1990). Problémes rencontrés dans mon parcours mathématique: Un bilan. *Publications mathématiques de l'IHÉS* 70: 199–214.

Wang Dongming 王东明, Gao Xiaoshan 高小山, et al. (2010). Shuxue jixiehua fazhan huigu 数学机械化发展回顾 (Review of the Development of Mechanization of Mathematics). In *Wu Wenjun yu Zhongguo shuxue* 吴文俊与中国数学 (*Wu Wen-Tsun and Chinese Mathematics*), edited by Jiang Boju 姜伯驹, Li Banghe 李邦河, et al., 221–34. Singapore: World Scientific.

Wang, Hao (1960). Toward Mechanical Mathematics. *IBM Journal* 1960, no. 1: 2–22.

Wang Lili 王丽丽 and Li Xiaoning 李小凝 (1998). *Chen Jingrun zhuan* 陈景润传 (*Chen Jingrun's Biography*). Beijing: Xinhua Chubanshe.

Wang Yao 谈谈 (1975). Tan tan Zhongguo shuxue shi 谈谈中国数学史 (About the History of Chinese Mathematics). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 18, no. 3: 157–61.

Wang Yuan 王元 (1999). *Hua Loo-Keng: A Biography*. Singapore: Springer.

Wu Wen-Tsun (1948). On the Product of Sphere Bundles and the Duality Theorem Modulo Two. *Annals of Mathematics* 49, no. 3: 641–53.

Wu Wen-Tsun 吴文俊 (1953). Youxian ke peifen kongjian de xin tuopu bubianliang 有限可剖分空间的新拓扑不变量 (Topological Invariants of New Type of Finite Polyhedrons). *Shuxue Xuebao* 数学学报 (*Acta Mathematica Sinica*) 3, no. 4: 261–90.

Wu Wen-Tsun 吴文俊 (1959a). Boyi lun zatan: (yi) er ren boyi 博奕論杂談:(一)二人博奕 (On Game Theory: No. 1, Two-person Games). *Shuxue Tongbao* 数学通报 (*Mathematics Bulletin*) 10: 339–44.

Wu Wen-Tsun 吴文俊 (1959b). A Remark on the Fundamental Theorem in the Theory of Games. *Science Record* 3: 229–33.

Wu Wen-sun 吴文俊 (1976a). Theory of *I**-Functor in Algebraic Topology—Effective Calculation and Axiomatization of *I**-Functor on Complexes. *Scientia Sinica* 19, no. 5: 647–64.

Wu Wen-Tsun 吴文俊 (1976b). Wenhua da geming wei shuxue yanjiu kapi le guangkuo de qiantu 文化大革命为数学研究开辟了广阔的前途 (The Cultural Revolution Opened up a Broad Future for Mathematical Research). *Yingyong shuxue xuebao* 应用数学学报 (*Acta Mathematicae Applicatae Sinicae*) 1, no. 2: 13–16.

Wu Wen-Tsun 吴文俊 (1977). Chudeng jihe panding wenti yu jixiehua zhengming 初等几何判定问题与机械化证明 (On the Decision Problem and the Mechanization of Theorem-Proving in Elementary Geometry). *Zhongguo Kexue* 中国科学 (*Scientia Sinica*) 6: 508–16.

Wu Wen-Tsun 吴文俊 (1978a). Shuxue de jixiehua wenti 数学的机械化问题 (The Problems of Mechanization of Mathematics). In Wu 1996: 373–74.

Wu Wen-Tsun吴文俊 (1978b). Shuxue gaikuang ji qi fazhan 数学概况及其发展 (The State of Mathematics and Its Development). In Wu 1996: 9–21.

Wu Wen-Tsun 吴文俊 (1980). Shuxue de jixiehua 数学的机械化 (Mechanization of Mathematics). *Baike zhishi* 百科知识 (*Encyclopedic Knowledge*) 3: 41–44.

Wu Wen-Tsun 吴文俊 (1981). Gu zheng fuyuan de yuanze 古证复原的原则 (Principles of reconstruction of proofs). *Shijie kexue* 世界科学 (*World Science*) 10: 56.

Wu Wen-Tsun 吴文俊 (1982). Wo guo gudai cewang zhi xue chongcha lilun pingjie jian ping shuxe shi yanjiu zhong mouxie fangfa wenti 我国古代测望之学重差理论评介兼评数学史研究中某些方法问题 (On the Double-Difference Theory in Ancient Chinese Surveying, with Comments on Certain Methodological Questions in the History of Mathematics). *Keji shi wen ji* 科技史文集 (*Papers on the History of Science and Technology*) 8: 10–31.

Wu Wen-Tsun (1984a). Basic Principles of Mechanical Theorem Proving in Elementary Geometries. *Journal of Systems Science and Mathematical Sciences* 3, no. 3: 207–35.

Wu Wen-Tsun 吴文俊 (1984b). Zai Jiaoyu bu zhuban de quanguo gaoxiao zhong wai shuxue shi jiangxi ban kaixue dianli shang de jianghua 在教育部主办的全国高校中外数学史讲习班开学典礼上的讲话 (Talks at the Opening Ceremony of the National Higher Education Seminar on Chinese and Foreign History of Mathematics Organised by the Ministry of Education). *Zhongguo shuxue shi lunwenji* 中国数学史论文集 (*Papers on the History of Mathematics in China*) 2: 1–8.

Wu Wen-Tsun (1986). Recent Studies of the History of Chinese Mathematics. In *International Congress of Mathematicians, 1986: August 3–11, Berkeley*, edited by Andrew M. Gleason, 2: 1658–67. Berkeley: University of California.

Wu Wen-Tsun, 吴文俊 (1987). Dui Zhongguo chuantong shuxue de zai renshi 对中国传统数学的再认识 (A New Understanding of Chinese Traditional Mathematics). *Baike zhishi* 百科知识 (*Encyclopedic Knowledge*) (7): 48–50. (8): 43–46.

Wu Wen-Tsun 吴文俊 (1988a). Shuxue 数学 (Mathematics). In *Zhongguo da baike quanshu* 中国大百科全书 (*Great Chinese Encyclopedia*)*: Shuxue* (*Mathematics*), 1–3. Beijing: Zhongguo da baike quanshu chubanshe.

Wu Wen-Tsun, 吴文俊, ed. (1988b). *Xiandai shuxue xin jinzhan* 现代数学新进 展 (*New Advances in Modern Mathematics*). Hefei: Anhui keji chubanshe.

Wu Wen-Tsun (1996). *Wu Wenjun lun shuxue jixiehua* 吴文俊论数学机械化 (*Wu Wen-Tsun on the Mechanization of Mathematics*). Jinan: Shandong jiaoyu chubanshe.

Wu Wen-Tsun 吴文俊 (2002). Some Reflections on Mechanization of Mental Labour in the Computer Age. *MM Research Preprints* 21: 1–5. (http://www.mmrc.iss.ac.cn/pub/mm21.pdf/wu.pdf).

Wu Wen-Tsun 吴文俊 (2003). *Shuxue jixiehua* 数学机械化 (*Mechanization of Mathematics*). Beijing: Kexue chubanshe.

Wu Wen-Tsun 吴文俊 (2004). Tansuo yu shijian—wo de kexue yanjiu licheng 探索与实践—我的科学研究历程 (Explorations and Practice—The Course of My Scientific Research). In *Kexue de liliang* 科学的力量 (*The Power of Science*), edited by Yu Xianglin 余翔林 and Deng Yong 邓勇, 11–20. Beijing: Kexue jishu chubanshe.

Wu Wen-Tsun 吴文俊 (2008). *The Selected Works of Wen-Tsun Wu*. Singapore and Hackensack, NJ: World Scientific.

Wu Yubin 吴裕宾, and Chen Xinghua 陈兴华 (1976). Wo guo zhong shiji jiechu de shuxuejia—Li Ye 我国中世纪杰出的数学家—李冶 (An Outstanding Medieval Mathematician of Our Country—Li Ye). *Shuxue de shijian yu renshi* 数学的实践与认识 (*Mathematics in Practice and Theory*) 6, no. 4: 6–11.

Xi Zezong 席泽宗, and Guo Jinhai 郭金海 (2011). *Xi Zezong koushu zizhuan* 席泽宗口述自传 (*An Oral Autobiography of Xi Zezong*). Changsha: Hunan jiaoyu chubanshe.

Zhang Baichun 张柏春 (2001). Dui Zhongguo xuezhe yanjiu keji shi de chubu sikao 对中国学者研究科技史的初步思考 (Preliminary Reflections on Studies of History of Science and Technology by Chinese Scholars). *Ziran bianzhengfa tongxun* 自然辩证法通讯 (*Journal of the Dialectics of Nature*) 23, no. 3: 88–94.

Zhang Meifang 章梅芳 (2003). "Pi Lin Pi Kong" yundong qijian Zhongguo ren de keji shi guan "批林批孔"运动期间中国人的科技史观 (Chinese Conception of History of Science and Technology during the "Anti-Lin Anti-Confucius" Campaign). *Kexue Jishu yu Bianzhengfa* 科学技术与辩证法 (*Science, Technology and Dialectics*) 20, no. 3: 48–52.

Zhang Zhihui 张志辉, Sun Hongqing 孙洪庆, and Wang Gaofeng 王高峰 (2008). Da Zhi wei shi—Wu Wenjun xiansheng fangtanlu 大智为师—吴文俊先生访谈录 (An Interview with Mr. Wu Wenjun). *Kexue Wenhua Pinglun* 科学文化评论 (*Science and Culture Review*) 5, no. 5: 94–106.

Zhongguo kexueyuan shuxue yanjisuo 中国科学院数学研究所 (Institute of Mathematics of the Chinese Academy of Sciences) (1958). Ji Zhongguo kexueyuan shuxue yanjiusuo pipan zichan jieji xueshu sixiang 记中国科学院数学研究所批判资产阶级学术思想 (Recording the Criticism of Bourgeois Academic Thought in Institute of Mathematics of the Chinese Academy of Sciences). *Shuxue tongbao* 数学通报 (*Mathematics Bulletin*) no. 10: 4–6.

Zhongguo kexueyuan shuxue yanjiusuo 中国科学院数学研究所 (Institute of Mathematics of the Chinese Academy of Sciences) (1966). *Yanjiusheng fenpei dengji biao* 研究生分配登记表 (*Registration Forms for the Assignment of Graduate Students*). CAS Archives, file Z370-114/06.

Zhongguo kexueyuan shuxue yanjiusuo dang de lingdao xiao zu 中国科学院数学研究所党的领导小组 (Party Steering Group of Institute of Mathematics of the Chinese Academy of Sciences) (1976). *1976 nian shuxue suo keyan gongzuo jihua yaodian* 一九七六年数学所科研工作计划要点 (*Main Points of the Institute of Mathematics of the Chinese Academy of Sciences Research Work Plan for 1976*), 15 April. CAS Archives, file Z370-170/2.

Zhongguo kexueyuan shuxue yanjiusuo yunchou shi da pipan zu 中国科学院数学研究所运筹室大批判组 (Criticism Group of Operations Research Division of Institute of Mathematics of the Chinese Academy of Sciences) (1975). Shen Kuo de shuxue gongzuo—bing shi lun fa jia sixiang dui wo guo lishi shang kexue jishu fazhan de cujin zuoyong 深阔的数学工作—并试论法家思想对我国历史上科学技术发展的促进作用 (Mathematical Work of Shen Kuo—Plus an Attempt to Discuss the Stimulating Role of Legalist Thought on the Development of Science and Technology in Our Country). *Shuxue de shijian yu renshi* 数学的实践与认识 (*Mathematics in Practice and Theory*) 5, no. 1: 1–5.1.