Titles and abstracts for the ICHMM

I. Scientific Committee

Henri Poincaré's reflections on mathematical and scientific practice

Jeremy Gray
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Abstract : Poincaré led a public life as an intellectual, and reflected on many occasions on the nature of mathematics and its relations to physics. Poincaré's work on mathematical physics was guided by a strong commitment to an anti-realist position in physics, which he connected to our different ways of knowing about mathematics and the world. This talk will explore the roots of his position in contemporary physics and the controversies it led him into.

China and India: How Each Fashioned a Distinctive Professional Culture of Modern Mathematics

Joseph Dauben
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Abstract : How did new "professional cultures in mathematics" come to establish themselves in China and India in the 20th century? What were the foreign influences that were predominantly responsible for their development of modern mathematics? Who were the Chinese and Indian mathematicians primarily responsible for bringing this about? And how did the transformations affect both individuals and institutions? What was the nature of the mathematics and the mathematicians who studied and promoted the subject? By exploring the backgrounds, aims and activities of mathematical practitioners in China and India , the nature of the transition to modern, international mathematics in both countries will be analyzed and compared in as much detail as possible from the mid-19th century to about 1960.

The First World War as a source of British Mathematical Practice

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Abstract : 'This is a Mathematical War' declared a veteran British mathematician to his colleagues in January 1915. Two years later his words were echoed at the front by a young British soldier who found himself fighting in a 'war of guns and mathematics'. Were these accurate descriptions or isolated observations? What effect did the war have on British mathematicians and on the practice of their subject? To answer these questions, I shall consider the extent to which British mathematicians contributed their skills to the war effort, the nature of their contributions, and the consequences of the war for British mathematics.

Algebraic Practice in Victorian Britain

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Abstract: Analytic geometry and mathematical physics may have interested a majority of mathematicians in Victorian Britain, but algebra also served to focus their mathematical attention. In the century's first half, algebraic work centered on the development of the so-called "symbolical algebra" and the creation of new algebras, while in its second, the theory of invariants dominated and the abstract theory of groups witnessed key developments. Underlying much of this research was the philosophical question of how free mathematicians were to create new mathematical entities. The Victorian British response was ultimately, "quite," and that freedom not only characterized British algebraic practice in the nineteenth-century mathematical world but also distanced it from contemporaneous developments especially in nineteenth-century Germany.

Simplicity as a key epistemological value in the development of projective geometry in France (first half of 19th century)

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Abstract : In the approach to mathematical cultures I developed in [Chemla 2007, 2009, 2010], I followed the idea propounded in [Fox Keller 2002] that epistemological factors should play a key part in our account of how practitioners carry out scientific activity and why they aim at results of a specific kind. The talk goes on with this task, but it focuses on the development of synthetic geometry in France from the end of the 18th century onwards. The thesis in favor of which it argues holds that simplicity has been a key value in the emergence of projective geometry. Simplicity is reflected in many features of the mathematical practice evidenced by our sources. However, I shall stress that the meaning and the role devoted to simplicity evolves on the time span ranging between the end of the 18th century and the 1840s. At the beginning, simplicity was valued as an external constraint, bearing upon the content of descriptive geometry in a specific way (pragmatic value) [Monge, Dupin]. Simplicity then was an essential inspiration for how the dispositif of projective geometry was shaped. It represents a goal to be pursued and an outcome to achieve. Moreover, it operates at several levels (for instance, figures, proofs, connections between propositions) [Poncelet]. Simplicity lastly becomes an epistemic value geared towards the search for the ”genuine perfection in science,” on the basis of assumptions made on the nature and organization of geometrical knowledge [Chasles]. I hope by the example to cast light on the complexity of epistemological values and how they operate in scientific research.

Theory and Computations in Number Theory in the USA before 1935: A Tale Of Provincial Life

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Abstract : In 1940, Hermann Weyl wrote from Princeton to Paul Bernays that he was 'trying to stimulate the dormant interest in number theory' in his new country. Number theory started at this time its dramatic rise in the USA with strong contributions that in many respects can be seen as natural continuations of the traditions that had shaped research in the discipline in Germany (and also, though to a lesser extent, in France) after the publication of Hilbert's *Zahlbericht*.

In this lecture I present an overview of number-theoretical activity in the USA previous to the influential influx of mainly German-speaking mathematical immigrants following the rise of the Nazis to power in the mid-1930s. The local community of number theorists was small, and relatively isolated, and it was active mainly in the West Coast.

Of particular interest is the way in which computations with specific cases played a main role in all local number-theoretical research. This was in contrast with the main focus of mainstream research at the time in Germany, that promoted developing general abstract theories and paying little attentions to calculations. The idiosyncratic approach followed by USA number-theorists in the early twentieth century was crucial to paving the way for the eventual development of computational number theory, in which computer-based calculation and abstract theory combine in a new and fruitful way.

The rise of applied mathematics in Germany between 1890 and 1930 and changes in the profession of the mathematician

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Abstract : The development of mathematics in the three leading countries at the end of the 19th century, Germany, France and Italy, was largely determined by pure academic research and the training of teachers for secondary schools. As to Germany, engineering schools did not have the right to award doctor degrees, engineers were often skeptical with respect to teaching advanced mathematical subjects and to mathematical research. In the 1890s the mathematician at the university of Göttingen, Felix Klein (1849-1925), tried to introduce reforms in teacher training and to contribute to a mutual rapprochement of traditional universities and engineering schools. He largely failed on the second count but succeeded in introducing an exam in applied mathematics for mathematics teachers in the German state of Prussia in 1898 and, as a consequence, in the establishment of a few professorships for applied mathematics at universities. At the same time, Klein and others supported the creation of new professional careers for mathematicians, in particular as insurance mathematicians. Since the 1920s the first jobs in German industrial laboratories (AEG, Siemens) were created which were particularly destined for mathematicians trained at universities.

The talk will focus on Klein's reform and on the work of one of his most influential followers, the director of the institute for applied mathematics at Berlin University between 1920 and 1933, Richard von Mises (1883-1953).

Mathematics and the Data-Driven Science

Theodore Porter

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Abstract : The increasing unworldliness of “pure” mathematics in the nineteenth century was balanced by a huge expansion of technical tools and the forging of new mathematical disciplines devoted to highly practical ends. These fields drew from the mathematical tradition, yet were shaped by the needs of scientific, commercial and state institutions to solve quantitative problems and to systematize and draw inferences from great storehouses of data. This paper examines the mutual shaping of statistical mathematics and quantitative practices for managing human populations involving insurance, poverty, health, and heredity.

Poincaré, Stability Theory, and Saturn's Rings

Thomas Archibald

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Abstract : In the 1880s Henri Poincaré became occupied by a series of researches concentrating on the stability of solutions of differential equations. In the course of these investigations, he turned to the question of stability of figures of equilibrium of rotating fluid masses. His work on this question seems to have been stimulated by two rather surprising sources: Kovalevskaya, whose work on Saturn's rings from 1874 was reworked for publication in 1884 in connection with her bid for a position in Stockholm; and the discussion of the subject in the second edition of Thomson and Tait's Treatise on Natural Philosophy of 1882, which contained a large number of novel equilibrium results, for the most part without proof. Poincaré found an infinite number of figures of equilibrium, and posited a universe in which branch points in what we would now term the solution spaces could lead to a variety of configurations, for example a planet with a satellite. In this context the rings of Saturn were particularly interesting. One of the most striking features of the universe in the late nineteenth century, the promise of a mathematical account of the rings was a demonstration of the power of mathematics in the description of nature. In this paper, we discuss aspects of the stability problem and the role that new applications of mathematics to celestial mechanics had in enhancing the prestige of mathematics in the late nineteenth century.

Two Different Strands of Thought in the Emergence of the Concept of a Convex body: Epistemic Objects and Techniques

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Abstract : Two simultaneous episodes in late nineteenth century mathematical research, one by Karl Hermann Brunn (1862-1939) and another by Hermann Minkowski (1864-1909), have been described as the origin of the theory of convex bodies. Pieces of Brunn’s and Minkowski’s work will be compared and analyzed using the methodological framework of epistemic objects and techniques, with the aim to understand (1) how and why the concept of a convex body emerged, and (2) why Minkowski’s strand of thought let to the development of the modern theory of convexity. It will be concluded that Brunn and Minkowski worked with different epistemic objects and used different epistemic techniques, and it will be argued that this had a significant influence on the mathematics they developed, which can provide answers to the questions listed above.

Theory of algebraic functions in 19th and 20th centuries

Ueno Kenji

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Abstract: I will discuss history of theory of algebraic functions in 19^{th} and 20^{th} centuries developed mainly by Abel, Riemann, Max Noether, Dedekind, E. Artin and Hasse.

2、Invited Speakers:

Working with spheres in 3-dimensional space: the culture of problems at Paris Polytechnic School around 1800

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Abstract: Mathematics was central in the curriculum of the Polytechnic School, founded in 1794. Students were trained in analysis and geometry under the supervision of famous mathematicians like Monge, Lagrange and Fourier. Strong emphasis was put on solving problems and original research works were undertaken by the best students. In this context, questions about contacts of circles and spheres were thoroughly investigated by a generation of young mathematicians, geometrical reasoning and analytical methods in parallel.

In this talk, we will present this new culture of problems, and focus on Dupin's research on the contacts of spheres, which led him to discover a new class of surfaces, the cyclids, which interested many mathematicians after 1850, including Cayley and Darboux.

The American Journal of Mathematics: Culture and Practice

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Abstract: In 1878, under the auspices of Johns Hopkins University, James Joseph Sylvester founded The American Journal of Mathematics (AJM) as a venue for mathematicians to exchange ideas with the expressed goal of propagating mathematical knowledge in the United States. Nearly half of the contributions during the first decade came from Sylvester and his colleagues at Johns Hopkins, but, over time, both the number of contributors and the size of the readership expanded. This paper will discuss the contents of the journal and examine its role in standardizing mathematical practice in a developing mathematical research and publication community. To what extent did the AJM delineate such a community (or communities) with a shared professional culture? What, if any, particular mathematical practices did the journal promote?

Mathematics by thought and by hand, today and in the past

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Abstract: will be sent later

The convergent problems of infinite series in Chinese mathematics in the 18-19th centuries

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Abstract: The topic of this paper will be the convergent problems of infinite series in the 18-19th centuries' Chinese mathematics. We are going to discuss following questions:

How did Chinese mathematicians encounter and realize the convergent problems of infinite series? How did they treat those problems? What is the difference between the Chinese problems and corresponding western problems?

In the early 18th century, three expressions of infinite series for calculation of *pi* and *sine* and *versine* which were obtained by I. Newton(1642~1727) and J. Gregory(1638-1675) were introduced into China by French Jesuit missionary Pierre Jartoux (1668~1720, Chinese name 杜德美 Du Demei). Ming Antu (明安图, a.1692~a.1765), a Mongolian mathematician in Astronomical Bureau of Qing, spent his leisure-time of thirty years in studying the infinite series and his work was followed by a dozen mathematicians of the 19th century. They derived dozens of infinite series about trigonometric functions and versed-trigonometric functions, logarithmic functions and power functions. These studies formulized a very active field of Chinese mathematics in the 19th centuries.

Ming Antu open the way of the studies of problems equivalent to the convergent speed of infinite series in the 18th century. His work was continued by other mathematicians in the 19th century.

Generally speak, Chinese mathematicians had not realized the convergent problem of infinite series. This is decided by their research methods. They started their works from geometrical analyses and then they combined algebraic method with geometrical models, which ensured the convergence of obtained series. But when they applied their infinite series in concrete computation, the problem of so-called descending place block in their way. They, therefore, had to study the improvement of their formulae to speeding up their computation so that the obtained infinite series could work well practically. It led them to consider the problem of convergent speed. They developed several other transfer formulae to speed up the convergent speed of infinite series.

Chinese mathematicians also encountered infinite series in their studies in logarithm and pile up of heaps. Both of them led to the problem of descending place, and therefore to the studies of convergent speed.

The concept of convergence of infinite series saw its beginning firstly in Gregory's work, but in the time of L. Euler (1707~1783), a mathematical analysis giant in the 18th century who was younger than Ming Antu about 15 years, European mathematicians had also not realized clearly the convergent problem of infinite series. The situation, however, changed in Europe in the 19th century.

A.L. Cauchy (1789～1857) defined the convergence rigorously and provided the rules to decided the convergence of an infinite series. The Chinese did not know it until 1859 when the first Chinese translation of calculus work was published.

Social Status of 19th Century Mathematicians in China, Japan and Korea: Li Shanlan, Fukada Riken and Nam Pyong-gil (1820-1869)

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Abstract: This article will be devoted to a preliminary study of social status of 19th century mathematicians in East Asia. The examples under study are Chinese Li Shanlan (1811-1882), Jaapanese Fukada Riken (1815-1889) and Korean Nam Pyong-gil (1820-1869). And the reason why the three are picked for the theme is their contemporary role in transmitting Western mathematics. For Li Shanlan, he, in collaboration with English missionaries, was responsible for introducing Western (symbolic) algebra, analytic geometry and differential and integral calculus, among others, to China from 1850s onwards. This is a significant episode in the history of Chinese mathematics which signals the beginning of Chinese modern mathematics. Moreover, his career, first as a traditional mathematical practitioner, then the translator of Western science and technology and finally the imperial college mathematics instructor, also witnessed professionalization and institutionalization of Chinese mathematics in the nineteenth century.

Partly parallel to Li's career, Fukuda Riken served first as a *Wasanka* (traditional Japanese mathematician), then a promoter of Western mathematics, in cooperation with his second son Fukada Jiken (1837-1888) and finally a post at the Meiji government's new astronomical office. However, in his youth Fukuda Riken did one more venture, namely, founding in Osaka the *Juntendo* private school whose goal was basically to teach *Wasan* (traditional Japanese mathematics) to the kids of common people.

By contrast with Li Shanlan from a humble literati family and Fukuda Riken from a merchant family, Nam Pyong-gil had a totally different family background. Born in a *Yangban* (*Choson* ruling class) family, Nam Pyong-gil passed the central civil examination and served as the acting Minister of the Personnel and the Minister of the Punishments. In 1862, he was even appointed to be one of the vice councilors of the *Uijongbu* (the State Council), the highest organ of the *Yi* government. Yet, one of his early official posts was to supervise the Observatory where he became the mentor of the staff, Yi Sang-hyok, a *chungin* (middle people) mathematician. This may in part explain why he ignored the *sadaebu*'s association of mathematics and the predominant *songnihak* (Chinese Song-Yuan neo-Confucian philosophy) and emphasized that mathematics deserved to be studied for its own sake. In fact, his mathematical treatises reflect a synthesis of Western mathematics transmitted to China and Korean adapted version of Chinese Song-Yuan mathematics. His devotion to mathematical study and his funding of printing Yi Sang-hyok's mathematical treatises might have successfully raised the epistemological status of the discipline and in turn improved the social status of its practitioners, the *chungin* mathematicians.

As the three case's study will show, social status of mathematicians in transition was not only closely related with the improvement of epistemological status of mathematics, it also witnessed a process of professionalization which eventually helped transform Chinese, Japanese and Korean

traditional mathematical practitioners respectively into modern mathematicians in the second half of the 19th century.

Introduction of objects: Context and representations

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Abstract: The talk discusses a currently popular anti realist position, fictionalism, in the light of actual mathematical practice with the aim of formulating a more practice sensitive anti realist position. Fictionalism is based on the following three claims:

i) Our mathematical sentences and theories do purport to be about abstract mathematical objects, as platonism suggest, but

ii) there are no such things as abstract objects, and so

iii) our mathematical theories are not true.

The first claim has been questioned (Burgess in Phil. Math. 2004) since it requires an explanation of how it is possible that mathematicians either pretend to refer to mathematical objects while they actually know that there are none or whether they falsely believe that there are mathematical objects that they refer to. Burgess argues that none of the solutions are satisfactory. Two topics are at stake here. First is the question of what mathematical statements refer to, and second, is the question concerning mathematical truth. I propose that studies of the mathematical practice of introducing mathematical objects could throw some light into these problems.

Based on a case study on Riemann's introduction of his Riemann surfaces, I will suggest that mathematical objects are introduced, first by referring to previously accepted mathematical objects and, second that then they are sometimes put in a new context that makes it possible to formulate new properties of them. Thus I stress the importance of the concepts of reference and context in introducing new objects. Returning to the questions above, it will be argued that truth of mathematical statements depends on the context in which the mathematical objects are placed in. This entails that a standard correspondence theory of truth must be given up. Furthermore I will suggest that instead of talking about 'reference', we talk about representations, so that, for example, a Riemann surface represents an Abelian function, and that more generally, it is possible to describe mathematical practice as dealing with (systems of) representations that need not refer to independently existing abstract mathematical objects.

Between two disciplines: Van der Waerden and the development of quantum mechanics

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Abstract: The Dutch mathematician Bartel L. van der Waerden (1903-1996) is well known for his works in algebra and algebraic geometry as well as in the history of mathematics and astronomy. The fact that he also contributed to physics is less well known. In the late 1920s and

early 1930s van der Waerden published two articles on spinor calculus and a monograph on group theoretic methods in quantum mechanics. In my talk I will touch upon different elements of practice connected with the interrelation between mathematics and physics in the creation of modern physics.

Firstly, I will explore how van der Waerden's publications emerged. This will show that networks of physicists and mathematicians in Leiden (centering around Paul Ehrenfest) and in Leipzig (centering around Werner Heisenberg) played a vital role in their creation.

Secondly, I will sketch the then on-going controversial debate about group theoretic methods among quantum physicists ranging from rejection to approval, and contextualize van der Waerden's contributions to it. Unlike Eugene Wigner and Hermann Weyl who vigorously promoted group theoretic methods by trying to convince physicists that working with symmetry is at heart a physical perspective, van der Waerden took the physicists' difficulties with the new method seriously and tried to meet the demands of the working physicist, e.g. by developing a mathematical tool - the spinor calculus - to handle certain representations more easily. This might come as a surprise since at that time van der Waerden was one of the founders of modern abstract algebra.

Finally, the involvement of physicists with group theoretic methods also had an impact on algebra. The physicist Henrik Casimir found a purely algebraic proof of the complete reducibility of finite-dimensional representations of the three-dimensional rotation group SO(3) which van der Waerden was able to generalize for any semi-simple Lie-group.

Mathematical Philosophy of Takebe Katahiro

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Abstract: Takebe Katahiro (1664-1739) was a Japanese mathematician, who exposed his philosophy on Mathematical Research and on Mathematics itself. In the Tetsujutsu Sankei he recommended the inductive heuristic method in mathematical research and recognized a mathematical research would be successful once the character of a mathematical object and that of a mathematician were accommodated to each other, comparing his method of calculation of the circular coefficient with that of his master Seki Takakazu and citing his own discovery of the infinite power series expansion formula of an inverse trigonometric function. In the Taisei Sankei, he exposed Chapter 4 entitled the "Three Essentials" describing four classes of mathematical problems, the status of parameters in a problem and the classification of numbers. Note that his thought was based on Chinese traditional philosophy and on the achievement of Japanese mathematics in the Edo period. Note also could distinguish algebraic numbers and transcendental numbers.

The Meiji Restoration of 1868 was a turning point in the history of Japan from the feudalism to the constitutional monarchism. The "ordinance on school system" (1872) of the new government defined mathematics in Japanese schools to be of "European style" thus abandoning the Japanese traditional mathematics. This policy was proved to be efficient at least for a half century and Takebe's philosophy on Mathematics was buried in the complete oblivion.

Methods and Logic in Traditional Japanese mathematics

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Abstract: There are some methods and logic peculiar to traditional Japanese mathematics. Generally they resulted from national isolation. They might seem to be partial from present-day point of view, but gave actually sufficient conclusions for mathematicians in that time. My topic will deal with an example of such a mathematical cultural phenomenon.

On the Use of Problems: The case of the Cousin Problems (1883 - 1940)

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Abstract: A family of proble ms in the theory of functions of several complex variables, the so-called Cousin problems, provides a basis for a case study on the *use* of problems in modern mathematics. First studied by Poincaré and Cousin at the end of the Nineteenth century, these problems remained to a large extent unsolved for a quite long period of time; they can thus be used as "time capsules" so as to document how several generations of mathematicians attacked them, restated them, tried to connect them with other problems, split them in sub-problems etc. We will eventually focus on the 1940s, in which the Cousin problems were used as a template from which a new and abstract structure was designed by Henri Cartan. In contrast with the received view of Bourbaki as relying on *mother-structures* for an all-encompassing *exposition* of well-known mathematics, this should help flesh out Bourbaki's twofold claim that new structures can be *invented*, in order to *solve problems*.

The Professionalization of Chinese Mathematicians during 1860-1904

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Abstract : During the period of 1860-1904, in response to the Self-Strengthening Movement, mathematics education developed rapidly. This paper first analyzes the development of mathematical education, and presents a statistical analysis of the mathematical teachers. Then, it deals with the opportunity provided by the development of education for mathematicians to achieve economic independence and attain high social position, and discusses the relation between the development of mathematics education and the professionalization of mathematicians in China.

The Cultural Relativity of Logic——From an ethnographic point of view

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Abstract: This paper proposes the concept of general argumentation, based on which the family of logic is extended so that it contains the logics of other cultures in addition to modern logic. In virtue of the ethnographic data about Azande, the cultural relativity of logic is demonstrated from the descriptive perspective. Taking deductive method as the meta-method, we prove the cultural relativity of logic from the normative perspective. Finally, by Wittgenstein's concepts of language game and life form, it is shown that deductive method is also of cultural relativity.

BOURBAKI AND THE TWENTIETH CENTURY MATHEMATICS

B.S.YADAV (pass away)

Abstract :The purpose of the talk is to describe Bourbaki as the greatest mathematician of the twentieth century. Bourbaki, as we now know, is not an individual but a group of young French mathematicians who for long kept itself as a secret Society. This French Young Turks in mathematics, animated by a profound faith in the unity of mathematics with a keen desire to be 'universal mathematicians' undertook to derive the whole of mathematical universe from a single starting point which is the theory of sets. In nutshell, their treatise consisting of ten volumes is an intellectual construction of an edifice of mathematics, endowed with the profound unity, hierarchy of abstract structures built on a foundation of axioms, planned to last for 2000 years.

It is shown further that what they achieved in mathematics gave rise to 'the concept of mathematical structuralism' with far- reaching consequences going beyond the confines of mathematics. The mathematical structuralism which they introduced is considered as one of the most beautiful jewels of the twentieth century mathematics. The concept is so powerful and so fundamental that Bourbaki made it into the universal core of human thought.

Lastly, the decay of Bourbaki towards the close of the twentieth century and the role of Alexandre Grothendieck as a member of Bourbaki , known as the Ramanujan of France, is discussed in brief.

3、 Others

The first generation of "statisticians" in early 20th century China: a multicultural issue

Andrea Bréard
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Abstract: The introduction of statistical institutions and theories in early 20th century China took place in the context of administrative and educational reforms, which followed mainly Meiji Japan's political model after the Chinese defeat in the first Sino Japanese War. Constitutional and educational reform provided a territory to introduce statistical education in the curriculum of newly created modern style schools and to implant statistical institutions in the capital and the

provinces, where since early times bureaucrats had been collecting, compiling and manipulating numerical data for the imperial administration.

Who were then this first generation of 'statisticians' that staffed the newly established network of statistical agencies in the Ministries and Provinces and the Maritime Customs' Statistical Department ? What were their educational backgrounds, which were their career patterns, and their political positions and how were these linked to their statistical knowledge and practices ? In this talk, I will reflect upon these issues as determined by the available archival sources and analyze the professionalization of statisticians. It will turn out, that during the last years of the Qing dynasty, a plurality of statistical cultures co-existed within the central Statistical Bureau, and that the very nature and function of numerical data was perceived differently by groups with different cultural backgrounds.

Linear Programming from Von Neumann to G. B. Dantzig

Ao te gen (敖特根)
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Abstract: Linear programming can be viewed as part of a great revolutionary development which has given mankind the ability to state general goals and to lay out a path of detailed decisions to take in order to "best" achieve its goals when faced with practical situations of great complexity.

As it is well known, that G. B. Dantzig has founded "the Linear Programming" and was called "the father of linear programming". However, his work was founded on "the early work of Van Neumann and Leontief". Especially, founded on the work Leontief's "the Input—Output Model of the economy". In this paper, the author will study about the work of them.

On Logical and Philosophical Foundations of Mathematics – its Historical Development from Boole to Gödel (1847–1830) and an contemporary approach to the problem

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Abstract:

1. Introduction: Posing the task of investigations

The task of present investigation consists in the following: on the basis **(1)** of a critical historico-empirical treatment of the development of logical and philosophical foundations of Mathematics from Boole's «The Mathematical Analysis of Logic» (1847) to Gödel's «Über formal unentscheidbare Sätze der Principia mathematica und verwandter Systeme I» (1931), as well as **(2)** of revealing the contemporary tendencies of development of Logic, *to formulate and substantiate a contemporary approach to logical and philosophical Foundations of Mathematics* (besides the formulation of the last one shed additional light on the previous historical development of Foundations of Mathematics).

2. Theses about the successive steps of the process of development of logical and philosophical foundations of Mathematics from Boole's «The Mathematical Analysis of

Logic» (1847) to Gödel's «Über formal unentscheidbare Sätze der Principia mathematica und verwandter Systeme I» (1931)

It is possible to reveal in the process of development of logical and philosophical foundations of Mathematics from Boole's «The Mathematical Analysis of Logic» (1847) to Gödel's «Über formal unentscheidbare Sätze der Principia mathematica und verwandter Systeme I» (1931) the following six successive steps:

1) Preparatory step to investigations on logical and philosophical foundations of Mathematics realized **(1.1)** by means of fundamental research of Boole in the field of Symbolic Logic as well as **(1.2)** by means of his philosophical considerations close connected with the last one;

2) The step of starting investigations on logical and philosophical foundations of Mathematics, connected with **(1)** formation of Philosophy of Mathematics in a rigorous sense, treated as close related to the Foundations of Mathematics, **(2)** formation of the conception of logicism in an elementary form, limited to the problem of logical construction of the Arithmetic of Natural Numbers, **(3)** laying foundations of Set Theory, treated as defining the most elementary and in the same time the basic mathematical entity, **(4)** innovation in essence of the method of formalization, **(5)** laying foundations of modern Predicate Logic, usually called Classical Predicate Logic, and **(6)** constructing Foundations of the Arithmetic of Natural Numbers on the basis of **(6.1)** Set Theory and **(6.2)** Classical Predicate Logic – realized by means of the works of Cantor (the items 1, 3, 6.1) and Frege (1, 2, 4, 5, 6.2).

3) The step of unifying and systemic development of the ideas and results of Cantor and Frege in the works of Russell during the first decade of 20^{th} c. and especially in Whitehead's and Russell's «Principia Mathematica» (1910-1913).

4) The step of intuitionistic critics of "Classical Logic" and "Classical Mathematics" initiated by Brouwer in 1907 and resulting into creation of Intuitionistic Logical Systems by Kolmogorov (1925) and Heyting (1930).

(5) The step of Hilbert's formalism in response to the intuitionistic criticism to "Classical Mathematics".

(6) The step of Gödel's metamathematical theorems (1931 and their interpretation in antiformalistic sense.

3. New approach to logical and philosophical foundations of Mathematics

Taking into account the development of logical and philosophical foundations of Mathematics from Boole's «The Mathematical Analysis of Logic» (1847) to Gödel's «Über formal unentscheidbare Sätze der Principia mathematica und verwandter Systeme I» (1931), on the one hand, and some new tendencies of development of Philosophy of Science and Symbolic (Mathematical) Logic since N. Wiener's «Cybernetics», on the other hand, it is proposed **(1)** a new conception on the essence, system and scientific significance of Symbolic Logic, resulting into construction of some new logical systems, and further, on their basis **(2)** a new approach to logical and philosophical foundations of Mathematics.

Suan Biao He Bi: the first Textbook of Science Table in China

《算表合璧》——中国第一部多学科的近代科学用表

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Abstract: Suan Biao He Bi was inscribed in 1902 and used in teaching in new model schools. It is rich in content and roughly covers seven kinds of categories. It has 51 science tables including Astronomy, Geography, Mathematics, Physical, History, and so on. It is deliberate in table-making about principle, etc. From existing materials, Suan Biao He Bi is believed that is the first modern science table about interdisciplinary in China. Cui Chao-qing and Yang Bing were two authors of this book. They were committed to modern science education and taken excellent achievements.

Keywords: Cui Chao-qing; Yang Bing; Suan Biao He Bi; Science Table

摘要：《算表合璧》刊刻于 1902 年，作为当时新式学堂用于教学的科学用表，内容丰富，大致涵盖 7 个大类，共 51 个算表，包括天文、地理、数学、物理、历史等学科，并注意介绍算表制作原理等相关内容。从已有资料来看，可以说，《算表合璧》是中国第一部多学科的近代科学用表。崔朝庆和杨冰是该书的两位主要编著者，他们主要致力于中国近代科学教育事业，成就卓越。

关键词：崔朝庆；杨冰；《算表合璧》；科学用表

Shiing-Shen Chern and three Institutes of Mathematics
陈省身与三大数学研究所

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Abstract: This paper studies great mathematician Shiing-Shen Chern's all life and his important scholarship from history of science. The paper stresses on three famous mathematical institute, which he founded and presided, Center Academe Mathematical Institute, Mathematical Science Research Institute, Nankai Mathematical Institute. This paper talks about detailedly on his work in every mathematical institute.

Key words: Shiing-Shen Chern , history of mathematics, mathematical institute

摘要：该文从科学史的角度研究了大数学家陈省身的生平与主要学术成就，重点研究了他创立和主持的三大著名数学研究所：中央研究院数学研究所，美国国家数学研究所，南开数学研究所。对他在每个数学研究所的工作都作了详细的阐述。

关键词：陈省身，数学史，数学研究所

Emmy Noether's first great mathematics, and the culmination of first-phase logicism, formalism and intuitionism

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Abstract: Emmy Noether stood out as gifted from the start of her work in mathematics. She became famous for work in Göttingen on conservation theorems in mathematical physics and

especially on commutative algebra. But her first great work was a tiny paper in 1916, when she was 34, written after she was invited to Göttingen but before she got there. Often seen as a step into Hilbert-style algebra, it is actually much more. It retains the symbolic-algorithmic influence of her doctoral teacher Paul Gordan. It presages her true signature in algebra which went far beyond both Gordan's formalism and Hilbert's axiomatics by synthesizing the two.

Mathematical Practice and Professional Cultures in WWI: The Case of French Ballistics.

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Abstract: The First World War has been called a "mathematical war" and for the first time in history mathematicians were heavily involved in warfare. Yet, the impact of this experience on the history of mathematics remains indistinct. I claim that a focus on mathematical practice and professional cultures is especially helpful in trying to assess the significance of WWI in the history of mathematics. As mathematical communities struggled to define the form that their mobilization would take, mathematical practice in military laboratories underwent strong challenges. I will examine the case of French ballistics in this light and see how mathematicians developed collaborative numerical table computation practices in response to the demands of ballisticians and artillerymen These experiences were crucial in redefining mathematical professional cultures after the war as well as on the eve of WWII, which would lead to even greater changes.

The Formation and the Development of the Linear Algebra Theories
线性代数理论的形成与发展

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Abstract: The linear algebra is an important branch of mathematics, is also an important foundation lesson in the university science and engineering each profession. The linear algebra not only developed mathematics calculation method on the technique, on the language it adequately embodiment the thought succinctness of the mathematics sign, and in lead to abstract algebra's the structure theories have can't neglect important function. We try from the whole angle of mathematics academics development explore the formation and development of the linear algebra theories, and point out some important mathematics thought in leaded to the abstract structure theories development.

Key words: linear algebra, abstract algebra, the structure theories, the calculation technique, mathematics thought.

摘要：线性代数是数学的一个重要分支，也是大学理工科各专业的一门重要基础课. 线性代数不仅在技术上发展了数学计算方法，在语言上充分体现了数学符号的思维简洁性，并在导向抽象代数的结构理论中具有不可忽视的重要作用. 我们试图从学科发展的整体角度考察线性代数理论的形成与发展，并指出其在导向抽象理论发展中的某些重要数学思想.

关键词：线性代数，抽象代数，结构理论，计算技术，数学思想

20 世纪上半叶中国数学名词的统一及其分析

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摘要：本文首先对 20 世纪上半叶中国经历过的由中国科学社、国民政府教育部等组织的几次较大范围和规模的数学名词的统一（把外文数学名词翻译成中文的数学名词，并对由同一个外文单词翻译过来的中文数学名词进行规范和统一）的过程进行了比较详尽的分析和研究，然后本文指出 20 世纪上半叶中国人越来越注重数学的交流和研究过程中的规范，并且对这一规范的重视程度已经上升到了制度化、体制化、国家机构的程度。

康德对哈密顿的影响

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Abstract: Hamilton read Kant's *Critique of Pure Reason* with enthusiasm in 1831. And he was deeply impressed by this book. It helped him to understand the foundation of algebra. The influence of Kant led to a lot of important fruitions. Sometimes, it was even essential for his achievements.

摘要：1831 年哈密顿怀着极大的热情阅读了康德的著作《纯粹理性批判》，深受康德哲学的影响，对代数的基础有了更深刻的认识。这一影响在一定程度上促使他在之后的研究中取得了许多重大的成就，有时甚至是决定性的。

The Evolution of Abstract Harmonic Analysis
抽象调和分析的理论发展历程

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Abstract: The Harmonic Analysis originated in the Fourier Analysis, and promoted set theory, integral theory, measure theory, functional analysis, generalized functions development in the history. Early 20th century, the Fourier analysis extended to the Lie group produced unexpected results. This paper attempts to interpret the history of abstract harmonic analysis theory.

Key words: Harmonic analysis, Fourier analysis, Lie groups

摘要：调和分析最初源于傅里叶分析，在历史上推动了集合论、积分理论、测度论、泛函分析、广义函数论等学科的产生与发展。20 世纪初，把傅里叶分析推广到李群上产生了意想不到的结果。本文研究了抽象调和分析理论的学科发展史。

关键词：调和分析，傅里叶分析，李群

The combination of mathematics and music—the comparison of the origination of the calculation of Temperament between ancient China and Greece

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Abstract：Since from the 5th and 6th century BC，there are lots of mathematician and musician all over the world try to illustrate the nature of musical sound. They use mathematics methodology to solve the theoretical issues regarding musical analysis, which lead to a close connection between music and math. The most typical countries are ancient China and ancient Greece.

In the ancient times, most content of acoustics are closely connected with musicology in both East and West. The connection between acoustics and mathematics are fully displayed in temperament of theoretical musicology.

According to the analysis and comparison, this paper tries to analyze the mutual relationship between mathematics and ancient Temperament theory in both East and West at the initial period of its creation, point out how to use mathematics method to explore the rules of the Temperament theory. Although their aims are different and they experience different ways, all of them create calculation methods of Temperament and analysis result.

The historical and bibliographical references across the scientific works of Gomes Teixeira (1851-1933)

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Abstract:During the second half of the 19th century, Portugal was isolated in terms of science. Francisco Gomes Teixeira (1851-1933), known and influent Portuguese mathematician, understood how deteriorative this isolation was to the science development in his country. He therefore, endeavored the opening of Portugal to the international scientific community, by starting several articles that were published in some of the most prestigious scientific journals of its time, and by establishing mail correspondence amongst several foreign scientists of many different areas.

During his investigation he didn't really developed any new mathematical theories. However, he had a great contribution to their development by presenting generalizations, clarifying and increasing research works published by other authors, turning into the pedagogical perspective of the presentation of mathematical texts, among others.

Two of his many works had international prizes: Tratado de las Curvas Especiales Notables and the Traité des Courbes Spéciales Remarquables Planes et Gauches. The first writings, responded to a set of requirements imposed by the competition established by the Academia de Ciencias Exactas, Fisicas y Naturales from Madrid, in 1893. Gomes Teixeira presented a text with excellent scientific and historical organization of each curve, having been therefore, awarded, in 1897, by the academy. Gomes Teixeira then announced that he would make a more detailed study

on the curves and he would broaden his study to other curves. In fact, he presented another writings, in French, named Traité dês Courbes Spéciales Remarquables Planes et Gauches, which resulted from the revision of Tratado de las Curvas Especiales Notables, with new studies and much more bibliographical and historical references on each curve.

Subsequently, in 1915, was published the Supplément ao Traité dês Courbes Spéciales Remarquables Planes et Gauches, in which Gomes Teixeira adds new scientific, historic and bibliographic developments of some already studied curves, and sets out the theories of other remarkable curves reproduced from other works, published in the period 1911 to 1915, in national and international journals.

The Binoux prize was attributed, in 1917, by the Academy of Paris, for the vast historical component considered with great accuracy and thoroughly treated [1].

The presented study is based on this historic side. With the support of the Base de dados das referências bibliográficas inseridas no Traité [2], in which is contained a table with the number of different authors reported in each curve, we have selected the curves (7) with more than twenty citations; amongst these we verified that three refer to the same chapter, named "Les courbes cycloïdales", being the other four distributed by three other chapters. Thus, we have a comparative study of the structure, the theorization and bibliographical references of that chapter in the works referred to above. In the theorization of curves listed in the said chapter, amongst the curves there treated, La cycloïde ordinaire is the one where are listed in greater number, the authors with more than twenty references in all the work. This fact led us to a comparative analysis of the development of this curve in both writings.

Mechanization of Tide Tables between Great-Britain and France in the 2d part of the 19th century

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Abstract: During the 1830s, the invention of the self-registering tide gauge radically changed the conditions in which tides were observed. It supplied a continuous description of the height of the tide in the harbor, whatever the time of day or night may be. It opened the way for the systematization of the observations, and for the organization of the corresponding calculus. In the 1870s, the importance of the data obtained led to the development of the harmonic analyzer and of the tide predictor by William Thomson (1848-1907), lately Lord Kelvin.

The history of this chapter in tide prediction focused on Great Britain, as we can see for instance in David E. Cartwright's book, Tides, a Scientific History (CUP, 1999). But in the 1830s, the self-registering tide gauge was invented in France too. The hydrographer Antoine A.-M. Chazallon (1802-1872) published the first Annuaire des marées des côtes de France in 1839, and in 1852, he presented a harmonic method for predicting tides – a method that hydrographers continued to refer to well into the 20th century, even though they rather bought tide predictors to Great-Britain.

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[1] Alves, Graça (2004)

[2] In Alves, Graça (2004), Francisco Gomes Teixeira – O homem, o cientista, o pedagogo

I intend to examine and compare the conditions in which analysis and tide prediction developed on both sides of the Channel. I will then explore the experiences of practitioners in other countries, where tide predictors developed or purchased in the first half of the 20th century.

Mathematics teachers at the beginning of Meiji era ——Introduction to a study of the transfers of knowledge occurring during the second part of the 19th century influences on teaching and general practices in geometry

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Abstract: After the intervention of Commodore Perry, Japanese authorities (first, under Tokugawa shogun, then during Meiji era) felt the necessity to integrate western pieces of knowledge in the education and to abandon the teaching of elaborate Edo mathematical tradition called the *wasan*. The aim was to modernize the country in order to be considered as a powerful equal by other major nations. A lot of Japanese works have been done on general history of mathematics and education, and on particular scholars of the Meiji Era. The aim of my thesis is to determine in a more specific way how this political revolution influenced the teaching of geometry and to see effectively how mathematical practices and teachers profession evolved from this.

In the early Meiji era, abroad studies proved to be fundamental as it influenced the syllabus of the teachers who had taken part, when they came back to Japan. During this period, there were also mathematicians that were initiated with *wasan* before studying western mathematics and their influence on the new mathematical education has to be considered. In order to analyze how the mathematical pieces of knowledge and teaching contents evolved, I have decided, for the moment, to concentrate on two types of sources. As the mathematical language is an important matter and a relevant way to determine mathematical contents, I selected some of the Tokyo Mathematical Society Translation Committee's reports. Japanese works showed that those committee's reports revealed conflict between the different types of mathematicians, and for my study I will analyze how the geometrical and logical vocabulary was fixed. To determine how the mathematical content and the pedagogical methods evolved in geometrical education, I mostly use the textbooks. As different types of mathematicians wrote those textbooks, I analyze some of their content and I will try to determine how they were spread and used effectively. Here are some of the concrete questions I ask in my thesis : What western education was taken as reference to constitute the new geometrical content and what were their characteristics (e.g. mathematical, didactic...) ? How was the new mathematical language fixed? How were the original western concepts adapted and what was the influence of the different types of mathematicians? What aspects of western education were used or adapted by Japanese teachers? How did the mathematicians adapt the form of the geometry textbooks considering the new mathematical content and how did they use Chinese translation or *wasan* works?

As I am only in the first year of my research, during the presentation I will evaluate the work I have already done once I have described more precisely my problematic and my methodology. I will then present the case of Kikuchi Dairoku in order to give an idea of how his stay in England

influenced, at first, the education in geometry. I will also present some of the concrete analysis that will compose my final thesis.

The Unification of Non-Euclidean Geometries

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Abstract: In the history of mathematics, The establishment of Non-Euclidean geometry is not only the geometry from the visual to abstract, but also the standard of the development of the geometry from the modern geometry to the contemporary geometry. Today, Non-Euclidean geometry is the necessary knowledge of solving practical problems in real life and the establishment of the Einstein theory of relativity, which is great significance and far-reaching for the study of space, nuclear world and the issues of naval aviation. Through the joint efforts of many mathematicians, ultimately they made the unification of Non-Euclidean geometries. Then, how to unite non-Euclidean geometry? The issue will be discussed in this paper.

The Historical Research about Yule's First Establishing Regression Analysis Method in Time Series

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Abstract: Beginning from Yule's life experience and study background, the article analyses the basic work and its significance about Yule's first establishing regression analysis method in time series, which is grounded on Yule's primitive thesis. Due to the puzzle about nonsense-correlation, Yule represented the time-correlation problem with especial reference to the variate-difference correlation method, and classified the time series by the correlation of first difference .When he researched Wolfer's sunspot numbers to investigate periodicities in disturbed series, Yule first established stationary linear autoregression *AR* (2) 、*AR* (4) model and regression analysis method. Last, after comparing the time domain analysis method with periodogram analysis, which was a frequency domain analysis method and established by Schuster, A. ,Yule opened up the new method in modern time series analysis.

Key words: Yule，G.U.; *AR* (*P*) Model; the Variate- Difference Correlation Method; Correlation

Remarks on the opposition "concrete" vs. "abstract" in 19th and 20th century mathematic

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Abstract: Two lines of exploration of this subject will be followed in the talk: on the one hand, occurrences of the opposed epithets will be systematically surveyed in a certain corpus of

the mathematical literature ; on the other hand, the meaning of the terms will be investigated in detail in a few specific contexts. These specific examples concern, among others, Leopold Kronecker, the Algebraic Geometry of the 1930s and 1940s, and German mathematicians of the 1930s.

Artin's Work on Galois Theory

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Abstract: Through the depth study of the original literature of the mathematicians who have made important contributions to the development of the theory about the general solution by radical of an algebraic equation, we try to reveal the innovative as well as the importance of Artin's specific work in the development of the theory. At the same time, the paper provides a learnable research program for the history of modern mathematics, which is to establish a balance between intellectual development and mathematics.

the history of abstract ring
抽象环概念的历史演变

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Abstract: Ring is the basis of abstract algebra.This paper historically expounds its evolution from number ring and polynomial ring to abstract ring.It is important to mathematicas itself and mathematical history.

Key words: number ring, polynomial ring, abstract ring

摘要：抽象环是抽象代数中的基本概念，重要性不言而喻。本文拟从抽象环概念的产生、发展和完善来解析它的来龙去脉，即如何从具体的数环、多项式环演变为现代数学中的抽象环。不仅能对抽象环的历史进行梳理考证，也对数学本身有一定的借鉴意义。

关键词：数环；多项式环；抽象环

W.T.Tutte and the renewing of matroid theory
W.T. Tutte 和拟阵论的复兴

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Abstract: Matroid theory, a branch of mathematics playing an important role in modern mathematics, is a new one emerging in 20th century. It was founded by H. Whitney from graph theory in 1935. Despite early contributions were made by G. Birkhoff and S. Mac Lane etc.，but its first major advances were made by W.T. Tutte in his Cambridge PhD thesis named *An Algebraic Theory of Graphs* in 1948. It established a sequence of important papers in late 1950s where regular matroids and graphic matroids were well characterized. Tutte's work reversed the near-stagnation developments of matroid theory, making it from Whitney's definition to a subject

with rich contents. This paper overviews the origins of matroid theory and its developments before Tutte. Then the following several main aspects are discussed: How Tutte renewed matroid theory is explored. His achievements on linear expression of matroids, structure of matroids and connectivity of matroids are reviewed. The important role of Tutte in the first formal conference of matroid theory was discussed. By which this paper explains that creating a new discipline is not easy, but saving one from the endangered failure needs more wisdom and vision.
Key words: Tutte，matroid theory，regular matroid，graphic matroid，linear expression of matroids，structure of matroids，connectivity of matroids

摘要： 拟阵论是 20 世纪数学的一门新兴学科，在现代数学中占有重要地位。1935 年，惠特尼从图论中开创了拟阵论。尽管 G.伯克霍夫和麦克莱恩等人早期对拟阵论也做了一些贡献，但拟阵论的真正进展是由塔特在其博士论文《图的代数理论》（1948）中做出的。他在 20 世纪 50 年代末发表了刻画正则拟阵和可图拟阵的重要论文，扭转了拟阵论近乎停滞的发展状态，使其从惠特尼的定义发展成为一门内容丰富的学科。本文首先概述拟阵论的起源，以及塔特以前拟阵的发展状况。在此基础上，从以下几个方面系统研究塔特如何复兴了拟阵论：拟阵的线性表示，拟阵的结构理论和拟阵的连通性理论，最后简要评述塔特在拟阵论第一次正式会议中的重要角色和意义。说明了建立一个新学科不易，拯救濒临衰竭的分支更需要智慧和眼光。
关键词：塔特 拟阵论 正则拟阵 可图拟阵 拟阵的线性表示 拟阵的结构 拟阵的连通

The Evolvement of the Thoughts in Abel's Proof

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Abstract:

Gauss's Contribution for Solving Algebraic Equation

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Abstract: Gauss proved the algebraic solvability of the equation $x^n - 1 = 0$, for any positive integer n. After Lagrange failed to solve the general algebraic equations of degree 5 and higher, he solved a particular class of special equations firstly. This paper investigated Gauss' main idea and procedures of solving the cyclotomic equations, and compared Lagrange's method and Gauss' method. Then it pointed out the relationship of Lagrange and Gauss. Finally, it explains that Gauss obtained a tower of radical field extension which changes the definition of radical solvability of the equation.

Development of the Theory of Self-Adjoint Domains of Ordinary Differential Operators

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Abstract：The main part of the paper will be devoted the development of the theory of self-adjoint domain of ordinary differential operators. We give all important characterization of self-adjoint domain of ordinary differential operators in terms of boundary conditions systematically in the regular case and in the singular case , and note that the contribution to the development of the theory of self-adjoint domain of ordinary differential operators were made by Coddington, Naimark, Everitt, Titchmarsh, Cao Zhijiang , SunJiong, Wang Wanyi,etc.

The Analysis of Chevalley's Work in the Class Field Theory
谢瓦莱类域论工作的分析研究

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Abstract: The early development of the class field theory has been reviewed, in particular Hilbert's research . With Chevalley's idele conception at the core, basing the exploration of its importance, the historical significance of Chevalley's work is reassessed. The conclusions are as follows: it is the conception of idele that makes Chevalley accomplish the global class field theory , as well as the purely arithmetic proof of the class field theory without analysis. Most importantly, by means of the idele conception, Chevalley's work integrated the topology and the functional analysis together with the class field theory. The presentation will provide some reference for the perspective on Chevalley's work..
Key words: Chevalley　class field theory　idele

摘要：简析了类域论的早期发展，尤其是希尔伯特的研究；以谢瓦莱引入的伊代尔概念为中心，深刻挖掘伊代尔概念的重要性，重新评价了谢瓦莱类域论工作的历史价值。指出正是借助伊代尔的概念，谢瓦莱摒弃了解析工具，完成了类域论的算术化过程，也建立了伊代尔叙述的整体类域论。更为重要的是，借助伊代尔的概念，谢瓦莱的工作直接将拓扑、泛函与类域论结合起来，促进了类域论的发展。这些研究对我们更全面、深刻的认识谢瓦莱的工作有借鉴意义。
关键词：谢瓦莱　类域论　伊代尔

Galois's Strategy

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Abstract:

Two Theorems on p-Radical Group

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Abstract: Let H be arbitrary subgroup of group G, we define three sets on them, then we define p-radical groups to use the properties of the three sets. Finally, we prove two interesting theorems about p-radical groups.
Key words: p-radical group; completely reducible module; annihilator; S_p-group; defect group

Origin and formation of biomathematics

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Abstract：

Behrens-Fisher Problem and the Contribution of Pao-Lu Hsu

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Abstract:

From the Roots Formula to the Resolvent

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Abstract:

On the masterpiece of inductive reasoning in East Asia: Tetsujutsu Sankei

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Abstract: *Tetsujutsu Sankei*(缀术算经) is the most important classic in the history of *wasan*,it is wrote by *wasan* mathematician *Takebe Katahiro* and also is his magnum opus of mathematics. This paper mainly analysed the mathematics thought in *Tetsujutsu Sankei* from the angle of Chinese-Character Cultural Circle first. It is helpful to understand the outstanding mathematical work comprehensively and make a fair and objective appraise. Second, under the view of mathematical methodology and the Neo-Confucianism of Song and Yuan dynasties, discussed the essential character of *Tetsujutsu* which runs through *Tetsujutsu Sankei* and *Takebe*'s mathematical thought and methodology reflected from the Jishitsu Setsu(自质说)at the end of the book.