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PROFESSOR LÊ VĂN THIÊM (1918-1991)

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Abstract

This article provides an academic overview of the life, career, and scientific contributions of Professor Lê Văn Thiêm, the founder of modern Vietnamese mathematics. It examines his early life, education in Europe, pioneering work in complex analysis and Nevanlinna theory, leadership in building Vietnam's scientific institutions, and his lasting influence on both theoretical and applied mathematics.

Keywords: Lê Văn Thiêm, modern Vietnamese mathematics, complex analysis, Nevanlinna theory, applied mathematics

Figure 1. Professor Lê Văn Thiêm

1. A Biographical Overview

Lê Văn Thiêm was born on March 29, 1918, in Trung Lễ Village, Đức Thọ District, Hà Tĩnh Province. Trung Lễ is an ancient village, established roughly six centuries ago in a low-lying area frequently threatened by droughts and floods. Its inhabitants were traditionally poor farmers but well known for their commitment to learning. As early as the 15th century, the

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village produced Trần Tước, who passed the imperial doctoral examination in 1496 (the Bính Thìn examination). The Lê family of Trung Lễ was especially renowned for its Confucian tradition and patriotism (Hà Huy Khoái, 2013, 2020).

His father, Lê Văn Nhiễu (1869-1929), passed the Cử nhân examination in 1900 (the Canh Tý examination). In the Confucian examination system, Cử nhân was a provincial-level degree, roughly below the imperial doctoral level, and it qualified successful candidates for scholarly and official careers. However, he chose not to become an official; instead, he remained in the village to teach, practice traditional medicine, care for his parents, and raise his children. His paternal grandmother, Phan Thị Đại, was the elder sister of the famous patriot Phan Đình Phùng. His paternal uncle, Lê Văn Huân, who earned the title Giải nguyên, meaning the highest-ranking candidate in a provincial examination, in 1906, took part in the nationalist movements of Duy Tân Hội and later the Tân Việt Party, and committed suicide in Vinh prison in 1929.


Cử nhân Lê Văn Nhiễu

Figure 2. A photograph of Lê Văn Nhiễu - Father of Lê Văn Thiêm

Although the family was steeped in scholarly achievements, it was even more deeply marked by its devotion to patriotic causes. The eldest brother of Lê Văn Thiêm, Lê Văn Kỷ, earned the imperial doctoral degree of Tiến sĩ Nho học in 1919. This title belonged to the traditional Confucian examination system and should be distinguished from the modern research doctorate or PhD. It was one of the very last such degrees obtained under the Nguyễn dynasty. Another brother, Lê Văn Luân, served as Party Secretary of the Indochinese Communist Party in Đức Thọ and was executed by the French in 1931. Among his five elder

sisters, two participated in the revolutionary movements of 1930-1931 and were later recognized as "Veteran Revolutionaries."

As the youngest child, Lê Văn Thiêm was affectionately called "Thêm" ("the child Heaven gave additionally"). He was frail at birth - his mother's thirteenth delivery - and was nursed by his sister-in-law, Sâm, the wife of Lê Văn Luân. Both she and her husband were active in the Tân Việt Party, a Vietnamese revolutionary nationalist organization active in the late 1920s, secretly distributing leaflets and revolutionary documents under the guise of peddlers.

Young Thêm initially studied under his uncle, Giải nguyên Lê Văn Huân, and was known both for his brilliance and his innocence. Here, Giải nguyên denotes the top-ranking candidate in a provincial Confucian examination. He later followed his eldest brother, "Nghè Kỷ"; Nghè was a respectful Vietnamese term used for a scholar who had obtained a high Confucian degree. He continued his studies in Huế and then Quy Nhơn.

Born into a family of patriotic scholars, Lê Văn Thiêm harbored from early on the aspiration to study in order to serve his country. In 1941, he passed the highly selective entrance examination of the École Normale Supérieure on Rue d'Ulm in Paris, the most prestigious institution of higher education in France, which trained many of the world's leading scientists. After graduating, he pursued doctoral research at Göttingen in Germany, then one of the most vibrant centers of mathematics. He completed his doctorate there in 1945, moved to Zurich to work with Nevanlinna, and later defended his Doctorat d'État in France in 1949 under the supervision of Georges Valiron, a leading authority in complex analysis.

Figure 3. A photograph of Lê Văn Thiêm taken in 1950

Lê Văn Thiêm's early mathematical results soon became classical contributions to complex analysis, opening for him a promising path toward major scientific achievements. But his foremost goal was to contribute to Vietnam's struggle for independence. Answering

President Hồ Chí Minh's call, he abandoned a brilliant academic career in Europe and secretly returned to Vietnam at the end of 1949, traveling through Bangkok and Cambodia to reach the resistance zones of Southern Vietnam.

In the South, Professor Lê Văn Thiêm joined the Indochinese Communist Party and worked at the Department of Education. He contributed to training many teachers for the resistance zone. Shortly after, he went to Việt Bắc to take up a new task: leading the first university center of the Democratic Republic of Vietnam. This was an important task and suited his abilities and aspirations. After six months of arduous walking from the South to the Việt Bắc resistance base, Professor Lê Văn Thiêm was appointed Principal of the Advanced Pedagogical School and the School of Basic Sciences. He did his best in that position and became a founder of university education in the new Vietnam, as well as the teacher of many Vietnamese scientists trained in the first ten or fifteen years after the August Revolution. After the restoration of peace, he held numerous major positions:

- Director of the Hanoi University of Education (1954-1956)
- Vice-Rector of Hanoi University (1957-1970)
- Founding Director of the Institute of Mathematics (1970-1980)
- Member of the National Assembly (2nd and 3rd legislatures)
- Plenipotentiary Representative of Vietnam at the Joint Institute for Nuclear Research in Dubna, USSR (1956-1980)
- Founding President of the Vietnam Mathematical Society
- Founding Editor-in-Chief of *Acta Mathematica Vietnamica* and *Vietnam Journal of Mathematics*

2. Major Scientific Contributions

2.1. Value Distribution Theory of Meromorphic Functions

The theory of value distribution of meromorphic functions is considered one of the most elegant theories of twentieth-century mathematical analysis. It may be seen as an extension of the fundamental theorem of algebra. According to that theorem, every polynomial of degree n has exactly n roots, counted with multiplicity. In a broad sense, entire functions are natural extensions of polynomials, since they can be represented on the whole complex plane by convergent infinite series. However, unlike polynomial theory, the theory of holomorphic functions cannot rely primarily on algebraic tools and must instead use analytic methods. The distribution of zeros of holomorphic functions, like the distribution of roots of polynomials, is one of its central problems. Yet fundamental difficulties arise immediately: because holomorphic functions are represented by infinite series, they may have infinitely many zeros in the complex plane, so no simple analogue of the fundamental theorem of algebra is possible. Although the order of growth is an important characteristic of holomorphic

functions, a direct extension of the fundamental theorem of algebra does not hold. Indeed, there exist holomorphic functions with very large growth, such as e^z, that have no zeros. For meromorphic functions, the problem is still more complicated, because such functions may also take the value infinity at isolated points; hence a new concept of growth is needed (Goldberg & Ostrovskii, 1970).

Nevanlinna's theory of value distribution was created to address these problems. Nevanlinna first defined counting and proximity functions, which may be briefly described as follows. Suppose f(z) is a meromorphic function on the whole complex plane, and let a be an arbitrary complex value. The counting function N(f,a,r) measures, in a precise sense, the set of points within a circle of radius r centered at the origin at which the function takes the value a. Thus, if f is a polynomial of degree n, then for sufficiently large r this value is a constant that does not depend on a, but only on the degree of the polynomial. The proximity function m(f,a,r) measures, in a precise sense, the set of points within a circle of radius r centered at the origin at which the function takes a value approximately equal to a.

The *Nevanlinna characteristic function* is defined by:

$$T(f,a,r)= m(f,a,r) + N(f,a,r).$$

Thus, roughly speaking, the function T(f,a,r) is used to estimate the number of solutions of the equation f(z) = a within a circle of radius r, including points at which the function takes values close to a. When studying meromorphic functions, the characteristic function T(f,a,r) plays a role similar to the degree of a polynomial. Nevanlinna's two fundamental theorems form the backbone of the theory and lead to the concept of deficiency, which measures how often a meromorphic function omits or under-attains certain values. Remarkably, the sum of all deficiencies is at most 2.

A natural and profound question is the *inverse problem*:

> *Given a sequence of complex values with prescribed deficiencies whose sum does not exceed 2, does there exist a meromorphic function realizing exactly those deficiencies?*

Nevanlinna solved a highly restricted version in 1932. For the next fifteen years or so after Nevanlinna's first results, the problem made little further progress. It was not until 1949 that Lê Văn Thiêm made a major advance in solving the inverse problem in Nevanlinna theory (Nevanlinna, 1932; Lê Văn Thiêm, 1949a, 1949b, 1949c, 1950).

Lê Văn Thiêm's contribution was not only to prove the existence of solutions to the inverse problem in more general situations than those considered by Nevanlinna, but also, importantly, to introduce for the first time the tools of pseudoconformal mapping and Teichmüller space into its solution. His ideas were later used by other renowned mathematicians, including Goldberg, Weitsman, and Drasin, to obtain further results on the inverse problem. Finally, in 1977, Drasin gave a complete solution to the inverse problem in Nevanlinna theory, 45 years after the problem had been posed. It is worth mentioning that

Drasin's work also used methods first applied by Lê Văn Thiêm (Drasin & Weitsman, 1974; Drasin, 1977).

The work on the inverse problem in Nevanlinna theory placed Lê Văn Thiêm among the classic authors of the field. As soon as the work was published, it was reviewed in Mathematical Reviews by Lars Ahlfors, who had received the Fields Medal in 1936. Ahlfors also reviewed several of Lê Văn Thiêm's subsequent works in that journal. To this day, almost every book on the theory of meromorphic functions, when discussing Nevanlinna theory, mentions Lê Văn Thiêm's early works. Not every scientist has the honor of seeing their results cited 70 years later. It is believed that Lê Văn Thiêm's works will be remembered for many years as milestones in the theory of meromorphic functions.

The article Beitrag zum Typenproblem der Riemannschen Flächen (On the problem of classifying Riemann surfaces), by Lê Văn Thiêm and published in Commentarii Mathematici Helvetici in 1947, was the first mathematical work by a Vietnamese scholar to appear in an international journal. The year 1947 can therefore be considered the opening year in the history of modern Vietnamese mathematics, and it is a matter of pride that Vietnamese mathematics joined world mathematics with a first work of historical significance (Lê Văn Thiêm, 1947).

Returning to Vietnam in 1949 at the call of President Hồ Chí Minh, Professor Lê Văn Thiêm temporarily stopped his scientific research to focus on important tasks assigned by the State. However, when there was a policy to promote scientific research in universities, he returned to his favorite field, the theory of Riemann surfaces. According to him, two works published in Sibirskii Matematicheskii Zhurnal and Acta Scientiarum Vietnamicarum in 1964 and 1965 were the result of studying a problem that he had been thinking about since his time in France but had not previously had the opportunity to complete. In those works, Lê Văn Thiêm proposed a condition for a covering surface to be a hyperbolic Riemann surface through the existence of "modular ends". He also gave conditions for a Riemann surface to belong to the class OHB, that is, a surface on which there is no non-constant internal harmonic function.

After the two works mentioned above, Professor Lê Văn Thiêm completely shifted to researching applied mathematics problems, following the policy of bringing science to serve production and wartime practice.

2.2. Contributions to Applied Mathematics

Originally renowned as an expert in the theory of meromorphic functions and Riemann surfaces, both areas of theoretical mathematics, Professor Lê Văn Thiêm later turned to applied mathematics and led research groups in this field. Remarkably, among his first works in applied mathematics was a study that became a classic in the field: the explicit solution of the problem of infiltration through two layers of soil. The infiltration problem has important

practical significance, arising in calculations related to the stability of dikes and dams, oil reservoirs, the desalination of coastal fields, and other engineering problems.

In many infiltration problems, for example, when considering water filtration through a long dike, one arrives at a planar model, that is, a model independent of one spatial dimension. Under some acceptable assumptions, the mathematical modeling of infiltration through a homogeneous medium involves constructing a holomorphic function that maps the infiltration region conformally onto the complex half-plane. However, even in that case, the model remains quite far from reality: the medium is assumed to be homogeneous, meaning that it consists of only one layer of soil with a single permeability coefficient. In practice, there are often many layers with different permeability coefficients under a hydraulic structure, such as clay layers and sandy soil layers. For non-homogeneous regions, until Lê Văn Thiêm's work, only approximate solutions were available. In the article Sur un problème d'infiltration à travers un sol à deux couches (On the problem of infiltration through two layers of soil), published in Acta Sci. Vietnam. 1, 1964, pp. 3-9, Lê Văn Thiêm used the principle of symmetry in complex analysis to construct an explicit solution for the problem of two layers of soil with different permeability coefficients. This was the first work in infiltration theory that allowed the construction of an analytic solution for a non-homogeneous infiltration problem. This result was confirmed in Theory of Groundwater Movement by Palubarinova-Kochina, published in Moscow in 1977 (Lê Văn Thiêm, 1964; Palubarinova-Kochina, 1977).

One applied research direction that Professor Lê Văn Thiêm and his students pursued for many years was directional blasting. The method of directional blasting was proposed by the Russian mathematician Lavrentiev, based on the following principle: when there is a large explosion, under extremely high pressure, the materials around the center of the explosion move according to the law of an ideal fluid, that is, an inviscid and incompressible fluid. The movement of the ideal fluid can be described by an analytic function. If this analytic function is found, one can calculate the pressure around the center of the explosion and the trajectory of the material near it. Realizing that this was a problem of great practical significance, Professor Lê Văn Thiêm guided his students at Hanoi National University and the Institute of Mathematics to study and apply it. In 1966, a group of young mathematicians from the two institutions, including Ngô Văn Lược, Lê Văn Thành, Nguyễn Văn Lâm, Hà Huy Khoái, Lê Hùng Sơn, and others, went to Nghệ An to conduct practical research on directional blasting. Their working location was the Hoàng Mai area in Quỳnh Lưu district. Hoàng Mai was the meeting point of three routes to the South: road, railway, and waterway, especially the Nhà Lê Canal, commonly known in Vietnamese as Kênh Nhà Lê. Therefore, it became one of the main targets of US aircraft bombing. Because the railway and road were severely damaged, transportation through the Nhà Lê Canal became very important. The canal was dug during the Lê dynasty and had become quite shallow. The urgent problem was to dredge the canal bed so that large-tonnage ships could pass through. The Youth Volunteer units were assigned

this task. However, it was impossible to concentrate a large force because US aircraft bombed day and night. Professor Lê Văn Thiêm proposed using directional blasting to dredge the canal bed. The goal was to ensure that after the explosion, most of the earth and rock would be thrown ashore, rather than falling back into the canal bed. The explosions were carried out at the lowest tide for maximum effectiveness. Therefore, in many cases, blasting had to be carried out during "peak hours", that is, the hours when American aircraft bombed most fiercely. In fact, the method of directional blasting was highly effective, contributing to increased transport capacity through the Nhà Lê Canal and reducing human and material losses. The method was also applied in the construction of strategic roads in the forest. The Youth Volunteers, together with the above-mentioned group of Professor Lê Văn Thiêm's students, applied the theory of directional blasting to break rocks, remove slopes, and knock large trees blocking the road down the cliff during road construction. Professor Lê Văn Thiêm wrote a manual for the Youth Volunteers so that they could do the work themselves after the research team withdrew from the site. Unfortunately, that manual cannot be found today.

After the country was reunified, Professor Lê Văn Thiêm moved to Hồ Chí Minh City. He established the Department of Applied Mathematics, researching mathematical problems in the theory of elasticity and the motion of viscous fluids. The applied mathematical problems that interested him were all raised by Vietnam's practical needs: building dikes and irrigation works, improving saline fields in coastal areas, calculating oil and gas reserves, and dredging canals to serve wartime traffic. While addressing immediate practical tasks, he also made important contributions to theoretical development, drawing on his strong foundation in basic science.

3. Building the Foundations of Vietnamese Mathematics

With his outstanding scientific works, Lê Văn Thiêm wrote the first page of the history of modern Vietnamese mathematics. He was also one of the first people to lay the foundation for the development of Vietnamese mathematics. His reputation was one reason why many talented young people went to the Việt Bắc War Zone to study and teach mathematics, including Hoàng Tụy and Nguyễn Cảnh Toàn. Moreover, Professor Lê Văn Thiêm not only attracted and encouraged them with his reputation, but also devoted his efforts to training the enthusiastic young generation of the early revolutionary period. His intellectual resources at that time were very limited, consisting of only a few books that he and some other professors had tried to bring with them all the way from Europe to the war zone. He always encouraged young talents to delve into scientific research and tried to create the best possible conditions for them.

Even after peace was restored, universities in Vietnam had almost no university-level mathematics textbooks in Vietnamese. Yet one of the great determinations of the Vietnamese State was to teach in Vietnamese at the university level. Lê Văn Thiêm translated and wrote textbooks, from Complex Variable Functions to Statistical Probability. Until 1964, students

were still borrowing textbooks from the library that he had translated and typed in unaccented Vietnamese. Perhaps because of his habit from his time in France, or to save time when writing, Professor Lê Văn Thiêm's Vietnamese often had no accents.

Recognizing the importance of mathematics in building the country's scientific capacity, Professor Lê Văn Thiêm, together with Professors Tạ Quang Bửu and Hoàng Tụy, outlined a long-term strategy for developing Vietnamese mathematics. The establishment of the Mathematics Research Department in 1962, under the State Committee for Science and Technology, was an important milestone in the process of building Vietnamese mathematics.

In 1969, Prime Minister Phạm Văn Đồng signed a decision to establish the Institute of Mathematics under the State Committee for Science and Technology. In 1970, Professor Lê Văn Thiêm, who was then Vice-Rector of Hanoi University, was transferred to the position of Deputy Director in charge of the Institute of Mathematics. From that time, the Institute of Mathematics officially came into operation.

Under the leadership of Professor Lê Văn Thiêm, from its establishment, the Mathematics Research Department, and later the Institute of Mathematics, focused on comprehensive development: basic research, applied research, and training. Outstanding graduates from Hanoi University and foreign universities were selected by Professor Lê Văn Thiêm himself for the Institute of Mathematics and were sent to continue their research and study abroad. Thanks to that basic training strategy, the Institute of Mathematics, from having just over 20 staff members in 1970, has become a leading research institute in Vietnam.

After the reunification of the country, Professor Lê Văn Thiêm began working in Hồ Chí Minh City. He established the Department of Applied Mathematics, with the mission of researching problems close to practical applications, especially problems arising in the South, such as irrigation in the Mekong Delta and oil and gas exploration.

Professor Lê Văn Thiêm, together with Professor Hoàng Tụy, were among the first to establish the Faculty of Mathematics of Hanoi National University. He always persevered in maintaining the quality of training, even during the war years, when the school had to evacuate to the mountainous region of Việt Bắc. He also had to go through many difficult struggles within the Faculty of Mathematics and Hanoi National University in the 1960s to maintain that correct strategy. Thanks to this effort, the Faculty of Mathematics of Hanoi National University, now the University of Natural Sciences under Vietnam National University, Hanoi, has trained many leading mathematicians in the country.

Professor Lê Văn Thiêm was also the first President of the Vietnam Mathematical Association. With his prestige, talent, and virtue, the professor was both a leader and a unifying nucleus of the Vietnamese mathematical community.

Dedicated all his life to the young generation, Professor Lê Văn Thiêm was one of the founders of the magazine Mathematics and Youth and directly wrote articles for it from its first issues. He also directly created the examination questions for excellent students in the

North in 1963-1964. He did not hesitate to do anything, big or small, as long as it was beneficial to guiding the young generation. Many excellent students who had difficulty applying to university because their families and relatives faced prejudices about their "background" came to him and received enthusiastic help. Many of them became good mathematicians and made many contributions to the country.

While the whole country was at war, with American planes fiercely bombing the North, Professor Lê Văn Thiêm founded the first Vietnamese journal of mathematics and physics in a foreign language: Acta Scientiarum Vietnamicarum (Sectio Mathematicarum et Physicarum). The mathematics section of that journal has now become Acta Mathematica Vietnamica, the most prestigious journal of mathematics in Vietnam, available in the libraries of many major universities in the world. Publishing a mathematics research journal in English, French, Russian, and German during wartime was a rare undertaking. Many foreign scientists were surprised and admired Vietnam, a country facing a devastating war in both regions, for thinking of publishing a scientific research journal in a foreign language. That work demonstrates the foresight of Vietnam's scientific leaders and their belief in the inevitable victory of the revolutionary cause.

It is difficult to say in a short article all that Professor Lê Văn Thiêm has done for the development of Vietnamese science. The development of Vietnamese mathematics, and of Vietnamese basic science in general since the August Revolution, bears the strong mark of Professor Lê Văn Thiêm.

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