

Francisco Gomes Teixeira

Francisco Gomes Teixeira was born at São Cosmado, a small village near Armamar, in the North of Portugal, near the river Douro, on the 28th January 1851.

He went to school at his native village and to the *Liceu* in Lamego. After a period of uncertainty regarding his future, during which he hesitated between Theology and Mathematics, he entered the University of Coimbra, the only one in Portugal at the time, and completed his degree in Mathematics in 1885 with the highest classification. He was still a student when he published *Desenvolvimento das funções em fracções contínuas*. He sent this work to Daniel Augusto da Silva (1814-1878), a Navy officer, author of some important work on Number Theory and on Mechanics, Professor at the *Escola Naval* in Lisbon and by then the most respected Portuguese mathematician. Da Silva acknowledged the reception of this work with words of high praise, encouragement and support. It was the beginning of a friendship that only finished with Da Silva's death.

In 1875 Gomes Teixeira presented a thesis *A integração das equações às derivadas parciais de 2^a ordem*, with which he obtained his doctor degree again with the highest classification. The following year he obtained a professorship with the work *Sobre o emprego de eixos coordenados oblíquos em Mecânica analítica*. In 1878 he also became a member of the *Academia Real das Ciências de Lisboa*.

In 1877, Teixeira received a letter from his friend Daniel da Silva, in which he complains about a recently published paper by Darboux about some work on Mechanics by Möbius and Minding. According to Da Silva, he had already obtained the results of Darboux himself twenty five years before, in a paper published in Portuguese in the *Memórias da Academia das Ciências de Lisboa*. Da Silva writes:

My memoir, which has many more things than those obtained by Möbius (...) lays down ignored for almost twenty six years in the libraries of almost all the Academies of the world. The reward of writing in Portuguese!

This letter must have made a strong impression in the

mind of the young mathematician, making him realise the isolation of the Portuguese scientific community. He soon began to fight this isolation: he wrote the main original results of his thesis in French and sent them to the *Mémoires de la Société de Sciences Physiques et Naturelles de Bordeaux* (where the paper was published in 1878); this kind of initiative was very unusual in the Portuguese scientific community of the time.



Francisco Gomes Teixeira (a drawing by his student Eleutério Fernandes)

This was just the first of a long series of papers he published in important mathematical periodicals, both national and foreign. To keep the examples to a minimum, he collaborated with Liouville's and Crelle's Journals and he was the first Portuguese to publish in *Acta Mathematica*. His interest in educational questions led him to publish also with *L'Enseignement Mathématique*, for example. He became a member of the scientific committee of this journal.

His main areas of work were Partial Differential Equations, Function Theory (namely series expansions), Geometry (properties of curves) and History of Mathematics. But he was not only interested in being known by the international mathematical community: he also intended that the Portuguese mathematical community became a part of that international community. Having this in mind and also the desire of popularisation

and diffusion of science, he founded in 1877 the *Jornal das Ciências Matemáticas e Astronómicas*, the first Portuguese journal devoted solely to mathematics. Important mathematicians such as Hermite and Bellavitis collaborated with their articles. Gomes Teixeira also visited several foreign Universities during his career, having personally contacted several European mathematicians (namely in Italy, France and Germany). Referring to this effort of internationalisation of science, he writes much later in a paper about Daniel da Silva:

Nothing can cause more damage to the scientific knowledge of a nation than its isolation from the science of the other nations. There was an almost complete isolation in Portugal during most of the XIX century and the main reason was the fact that our language was unknown in foreign scientific circles. Our journals were almost unknown outside the country and our scientists did not use the most widespread journals of foreign countries to present the results of their research. (...) the *Annaes da Academia Polytechica do Porto*, a journal to which I have tried to give an international character in order to fight the dangerous isolation of Portuguese science. (F. Gomes Teixeira, *Panegíricos e Conferências*, p. 160, 165)

Around this time Gomes Teixeira made a short incursion into politics. He was elected to Parliament by the *Partido Regenerador* in 1879 but, clearly, this was not his calling and he left the capital in 1884. In an interview much later to a Lisbon newspaper, he said:

I am and always have been deeply ignorant about politics. Look, I have been a member of Parliament at the time of Fontes! And I did not like it. As a parliamentarian, the best I have done at that time, when there was a splendid opera company in Lisbon, was to listen to magnific singing at S. Carlos. (*Diário de Notícias de Lisboa*, 7th March 1927)

In 1883 Gomes Teixeira asked to be transferred to Oporto, a requirement which was heartedly supported by the Politechnical Academy of that city. He entered it in 1884, having been assigned the fourth chair (*Descriptive Geometry*). The following year he moved to the second chair (*Differential and Integral Calculus; Calculus of Differences and of Variations*). The lessons he gave in this course were at the origin of one of the most important of his works, *Curso de Análise Infinitesimal*, which has known four different editions beginning in 1887. This treatise is divided into two volumes, with the subtitles *Cálculo Diferencial* and *Cálculo Integral*. The former was reviewed in 1904 by James Pierpont, professor at Yale, in the following terms:

While perusing the present book it was a constant source of regret to me that Portuguese is not better known in our country. Otherwise this admirable work on the calculus would enjoy widespread popularity among us. Its author, the distinguished director of the Academia Polytechnica at Porto, has been uniformly successful in the difficult task of selecting from the immense material available. The manner of presentation leaves nothing to be desired. The style is lucid and elegant, and the whole work bears in a refreshing manner the imprint of an original mind. In many places the author has incorporated parts of his own prolific and valuable writing on the subject. In regard to rigor, it seems to us that Professor Teixeira has very happily chosen the golden mean. The excessive rigor of a Weierstrassian has been wisely avoided; at the same time the author has given this matter due attention. An occasional slip will doubtless be corrected in later editions. Altogether the work has so favorably impressed us that we should prefer to see it translated into English rather than any other work on the subject we know of. It is a deplorable confession that the English language does not to day possess a work on the calculus of this class. (*Bulletin of the American Mathematical Society* 5, 1898 1899, p. 483-484)

James Pierpont goes on with a detailed analysis of the contents of Gomes Teixeira's treatise.

In 1897, the *Real Academia de Ciencias Exactas, Físicas y Naturales de Madrid* proposed a prize for an ordered catalogue of curves. The prize was awarded to Gomes Teixeira, with *Tratado de las Curvas Especiales Notables, tanto planas como alabeadas*, and to Gino Loria, with *Las Curvas Planas Particulares Algébricas y Transcendentes. Teoría y Historia*. A third work presented to the prize was *Catálogo General de Curvas*, by the architect Joaquín Vargas Y Aguirre. Henri Brocard presented *Vocabulaire des Courbes Géométriques et Notes Bibliographiques*, which, being written in French, was not admitted for the prize (although the Madrid Academy nominated Brocard as a foreign correspondent on account of this work). That work of Gomes Teixeira was translated into French, substantially augmented and published under the title *Traité des Courbes Spéciales Remarquables, Planes et Gauches*, in 1908, 1909 and 1915 (as was Loria's into German in 1910 under the title *Spezielle Algebraische und Transzendente Ebene Kurven. Theorie und Geschichte*). Teixeira's *Traité* became a well known reference book on curves, still quoted on works on the

subject, and had two reprints: one by Chelsea Publishing Co., New York, 1971 and the other by Éditions Jacques Gabay, Paris, 1995.

From 1904 to 1915, Gomes Teixeira's *Obras Completas* were published in seven volumes by the Portuguese government. The first two volumes contain articles on Analysis, such as partial differential equations, series developments of various kinds of functions, and on Geometry (properties of curves). His *Curso de Análise Infinitesimal* occupies volumes III (differential calculus) and VI (integral calculus), whereas the *Traité des Courbes Spéciales Remarquables, Planes et Gauches* is to be found in volumes IV, V and VII. The latter, dated 1915, contains a supplement on famous but elementary geometrical problems which cannot be solved with straightedge and compass.

The regular publication of the *Jornal das Ciências Matemáticas e Astronómicas* was not affected by Gomes Teixeira's transfer to Oporto, until 1905. In this year, the journal was replaced by the *Annaes Científicos da Academia Politécnica do Porto*.

The University of Oporto was founded in 1911, and the Politechnical Academy was converted into the Faculty of Sciences. The faculty was divided into sections, the first one of which was called *Ciências Matemáticas* and was further subdivided into two groups. Gomes Teixeira belonged to the first group (Analysis and Geometry) until 1925, when he asked to be transferred to the second one (Mechanics and Astronomy).

As the leading scientific personality of Oporto in his day, Gomes Teixeira was elected Rector of the University on the 16th June 1911, with many more votes than any other candidate. He kept this office until 1917 and in the following year he was made Honorary Rector. A further proof of his great prestige was given in 1921, when, in spite of having attained the age of seventy, he was reappointed as a Professor of the Faculty of Sciences of Oporto. He retired in 1929, when he reached the age limit.

His international reputation was manifest, since he received two honorary doctorates, from the Universities of Madrid in 1922 and Toulouse in 1923.

A short word should also be said about the correspondence of Gomes Teixeira, kept in the archive of the University of Coimbra. This is an interesting field of historical study, for he exchanged letters with some of the most important mathematicians of his time. It suffices

to say that he corresponded with Levi Civita, Peano, Mittag Leffler and Hermite.

From 1895 onwards Gomes Teixeira turned his attention to history. As he himself puts it:

When, the years passing, my mind became incapable of long and deep meditations, I decided to devote all my attention to the History of Portuguese Mathematics, holding lectures to expose some subjects that interested me the most. (Panegíricos e Conferências, prefácio)

Several of his papers, as well as the last editions of the *Curso de Análise* and especially the *Traité des Courbes Spéciales Remarquables, Planes et Gauches* reveal his growing interest on this subject. In 1917 the *Traité des Courbes* received the Binoux prize for the history of science from the French Academy of Science. Gomes Teixeira's *História das Matemáticas em Portugal* was only published posthumously in 1934.

In the last eight years of his life Gomes Teixeira also wrote five other books, which are neither of a mathematical nor of a strictly historical nature: *Panegíricos e Conferências* (1925), *Santuários de Montanha. Impressões de Viagem* (1926), *Apoteose de S. Francisco de Assis - sua vida e obra* (1928), *Uma Santa e uma Sábua* (1930) and *Santo António de Lisboa, história, tradição e lenda* (1931).

Gomes Teixeira died in Oporto on the 8th February 1933. By then a new generation of mathematicians was active, namely Aureliano Mira Fernandes (1884-1958), José Vicente Gonçalves (1896-1985) and Ruy Luis Gomes (1905-1984). Although Gomes Teixeira did not leave a "school" and none of these mathematicians had been a student of his, they greatly admired the old master and received his influence. All of them published (especially Mira Fernandes and Ruy Luis Gomes) in foreign journals and maintained contacts with foreign mathematicians (namely with Levi-Civita, a friend of Gomes Teixeira's) and their papers, even when written in Portuguese, were quoted by the international mathematical community. The isolation about which Daniel da Silva sadly complained in 1877 no longer existed. Certainly Francisco Gomes Teixeira played a major role in breaking that isolation.

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