PORTUGUESE MATHEMATICAL JOURNALS

SOME ASPECTS OF (ALMOST) PERIODICAL RESEARCH PUBLICATIONS

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To understand the *Practice of Mathematics in Portugal* in the 19th and 20th centuries a detailed analysis of periodical research publications is an important task that remains to be done. In this very preliminary study, we intend to present some notes and remarks starting from some publications of the *Academia das Ciências de Lisboa* and of the *Universidade de Coimbra,* continuing with a brief overview of the relevant periodicals, namely the *Jornal de sciencias mathematicas, physicas e naturaes* (Lisboa, 1866-1927), the *Jornal de sciencias mathematicas e astronomicas* (Coimbra 1877-1902) founded by F. Gomes Teixeira and, to a certain extent, continued in the *Annaes Scientificos da Academia Polytechnica do Porto* (Porto, 1905-1922), which was published after volume XV (1927) as *Anais da Faculdade de Sciencias do Porto*, the *2nd series A* of the *Revista da Faculdade de Ciências da Universidade de Lisboa* (Lisboa, 1950-1972), and finally and of great importance, the *Portugaliae Mathematica* (Lisboa, 1937), which is currently published by the *Sociedade Portuguesa de Matemática.* We conclude by discussing the importance of starting a national programme to digitize this scientific heritage, with a view to its integration in the future *Digital Mathematical Library.*

Introduction

The historical analysis of the development of mathematics, its contents, meaning and applications, must primarily be based on written sources. Among the mathematical publications, besides books, always a traditional means of communication, the importance of professional mathematical journals has increased during the last two centuries, so that it is nowadays impossible to understand the history of mathematical sciences without the study of this component, which is still largely unknown, with a few possible exceptions (see [N] for a bibliography or [G] for a particular recent study).

The first scientific journals appeared in Europe in the 17th century and were not specialized. Among the first to appear were the *Journal des Savants* and *The Philosophical Transactions* of the Royal Society of London, both started in 1665, and the *Acta eruditorum* (1682-1731), a scientific journal in which Leibniz published several mathematical papers. In the 18th century, academies and other learned societies continued to publish numerous scientific journals. The Enlightenment also created several other journals of a more popular scope and elementary nature, such as *The Ladies' Diary* or *Woman's Almanach* (1704-1804), which also included mathematical articles, and the *Mathematical Repository* (1741-1840).

The oldest mathematical journals still existing are the *Journal für die reine und angewandte Mathematik*, founded in 1826 by A.L. Crelle in Germany, and the *Journal de Mathématiques Pures et Appliquées*, created in 1836 by J. Liouville in Paris. These were preceded by the pioneering J.D. Gergonne's *Annales de Mathématiques Pures et Appliquées* (1810-31), which may be considered the first significant mathematical journal not associated with any academic institution [N]. They were followed in Great Britain by *The Cambridge (and Dublin) Mathematical Journal* (1839-54) and J.J. Sylvester's *The Quarterly Journal of Pure and Applied Mathematics* (1855-1927), and in Italy by the *Annali di Scienze Matematiche e Fisiche* (1850-57), edited by B. Tortolini, which continued as the *Annali di Matematica Pura ed Applicata* since 1858 and is still published today.

In the second half of the 19th century, the founding of several new mathematical societies created numerous new mathematical journals that still exist today, notably the *Proceedings of the London Mathematical Society* (1865), the *Matematicheskii sbornik* (1866) of the Moscow Mathematical Society and the *Bulletin de la Société Mathématique de France* (1872), as well as other local or national societies created in Prague (1872), Kharkhov (1879), Edinburgh (1883), Palermo (1884), Tokyo (1884), the DMV in Germany (1890), and the AMS in North America (1894). These societies contributed to the increasing number of publications that contained mathematical articles in that century from about two hundred, in 1800, up to more than six hundred journals by the beginning of the twentieth century.

It is interesting to note that the first specialized mathematical sciences journal appeared in statistics and in the history of mathematics [N], namely the *Journal of the Statistical Society of London* (1839), the *Journal of the American Statistical Association* (1888), *Biometrika* (1901), the *Bulletino di Bibliografia e di Storia delle Scienze Mathematiche e Fisiche* (1868-87), the *Abhandlungen zur Geschichte der mathematischen Wissenschaften mit Einschluss ihrer Anwedungen* (1877-1913), and the *Bibliotheca mathematica* (1884-1914), while specialized pure mathematics journals only began to appear in the next century, including the still existing *Fundamenta mathematicae* (1920), *Acta arithmetica* (1936), both published in Poland, and the *Journal of Symbolic Logic* (1936).

Another class of journals, not directly relevant to mathematical research but of great importance for the communication of mathematical knowledge, are elementary or intermediate mathematical journals, aimed at the training of students and teachers of mathematics in civil or military schools. Well-known examples are the French *Journal de l'Ecole Polytechnique* (1795) and *Nouvelles Annales de Mathématiques* (1842-1927), the German *Archiv der Mathematik und Physik* (1841-1920) and the still existing British *The Mathematical Gazette* (1894). In the Iberian world, according to [O], an earlier Spanish journal published in Cádiz in 1848, the *Periódico mensual de ciencias matemáticas y físicas* attempted to be a research journal, the Portuguese *Jornal de mathematica elementar* had a short life around 1883 and the *Revista de matemáticas elementales* appeared in 1889 in Buenos Aires, Argentina, following the example of the contemporary French *Journal de mathématiques élémentaires*.

Earlier Publications of the *Academia de Ciências de Lisboa* and of the University of Coimbra

The first books on mathematical sciences published in Portugal appeared before Pedro Nunes, namely the *Almanach Perpetuum*, by Abraham Zacutus, published in 1496 in Leiria, an influential book of astronomical tables used on the Portuguese voyages of the 16th century, and the *Tratado da Pratica d'Arismetyca*, by Gaspar Nicolás, published in 1519 in Lisboa, an elementary arithmetic book for commerce, written in the renaissance tradition of the *Summa Arithmetica* of Pacioli (1494), that went through eleven editions.

Although a few other books were published during the 17th and 18th centuries, particularly, partial translations of Euclid's *Elements* and the remarkable book *Principios Mathematicos* by José Anastácio da Cunha, published in Lisboa in 1790, the first institutional publications on mathematics in the form we recognize today as research articles can be found in the first volume of the *Memórias da Academia Real das Sciencias de Lisboa,* published in 1797.

At the end of the 18th century there was a slight revival of scientific life in Portugal, in a sense reflected and enhanced by the founding of the Academy of Sciences of Lisboa in 1779, which took place much later than the other European academies, including the Royal Society of London (1662) and the Academies of Paris (1666), Berlin (1700) and St.Petersburg (1724). By the end of the 19th century the Portuguese academy published a total of 38 volumes of its *Memórias* of the class of Mathematics, Physics and Natural Sciences, recently analysed in [D], and the *Jornal de Sciencias Mathematicas, Physicas e Naturaes*, which was published regularly

from 1866 until 1927, but with a vanishing interest for mathematical research, also because the majority of its articles were on subjects of natural history.

In spite of the fact that the Academy's prime concern has never been mathematics, and its activity in its first years was more important in the natural and economic sciences, the first Tome, corresponding to the period of activity between 1780 and 1788, opened in 1797 with a *Memoria* by José Monteiro da Rocha, an academician and professor of mathematical physics at the University of Coimbra, on a general solution of Kepler's problem on measuring barrels. This was an important applied question that had attracted the attention of several mathematicians since the publication of *Stereometria doliorum* by Kepler in 1615.

Probably more important among the *Memorias* of the initial decades were the contributions by Monteiro da Rocha, on the *Computation of the orbits of Comets*, read at the Academy in 1782, but only published in Tome II in 1799, and therefore losing priority of publication to the German astronomer Olberts who published a similar method in 1787; the reflections by Garção Stockler on the theory of fluxions and the foundations of infinitesimal calculus, read immediately after the publication of da Cunha's *Princípios,* but published only at the end of the 1790s, and also a method to solve numerically algebraic equations of any degree published in Tome II, but read by J.M. Dantas Pereira in 1794, which is essentially the method that Horner published a quarter of century later in 1819 in the *Philosophical Transactions of the Royal Society*. In a recent study [D], F.R. Dias Agudo also describes, as an example of how a few members of the Lisboa academy were then at the forefront of the knowledge of their time, a general method to solve algebraic equations of up to forth degree published by Simões Magiochi in Tome VII (1821), preceding its rediscovery by Olivier published in Crelle's journal in 1826.

Certainly the most important works published by the Academy of Sciences of Lisboa are those of Daniel Augusto da Silva (1814-1878), one of "the two outstanding Portuguese mathematicians of the second half of the 19th century" (see [S]), the other being Francisco Gomes Teixeira (1851-1933). In 1850, when he became a Corresponding Member of the Academy, D.A. da Silva, then professor at the Naval School, read his memoir *On the rotation of forces about their application points*, which was published in Portuguese in Vol. III, Part I (1851) pp. 61-231, of the Second Series of the *Memorias.* In this interesting and original work, D.A. da Silva showed that every system of forces has in general four and only four positions of equilibrium, correcting without knowing it a previous theorem by Möbius published in 1837 in his *Statica*, and anticipating by twenty-five years the results of Darboux, presented in 1876 at the Academy of Sciences of Paris (Compte-Rendus, LXXXII, p. 1284).

Another original work by D.A. da Silva was also published as a *Memoria* (New Series, Vol. 1 Part 1 (1854), pp. 1-164) on *General properties and direct solving of binomial congruences*. This was also a pioneering paper in that chapter of the number theory, in which he developed a symbolic notation for operating on sets and antecipated results on linear congruencies published by the Irish mathematician H.J.S. Smith in the *Philosophical Transactions of the Royal Society* in 1861, nine years after da Silva's presentation at the Lisboa Academy. All his other mathematical works were published in Portuguese by the Academy, in particular a short note on some new theorems in statics, which inaugurated the *Jornal de Sciencias Mathematicas, Physicas e Naturaes* in 1866, and the articles on actuarial calculus, demography and combustion, which were published in the same journal (see [GT]).

The *Jornal,* like the *Annaes das Sciencias,* another journal published by the Academy for a short period (1857-1858), has little interest as a research journal for the mathematical sciences, not only because it published mainly articles in the natural sciences, but also because the level and interest of the mathematical papers was not high. Nevertheless, we can find a list of mathematical papers published in these journals in *Le repertoire bibliographique des sciences mathématiques* (1894-1912), including a short note by F. Gomes Teixeira on an application of continued fractions to obtain roots of equations, published in volume 4 (1872) of the *Jornal,* while he was still in the third year of his studies at the University of Coimbra. It is

however interesting to note that this paper, as well as others published by him in that *Jornal,* are not included in any of the seven volumes of his collected works published in 1904-1915, possibly because they were written in Portuguese and their results were included in other publications by him.

Another journal that is listed in the *"Repertoire"*, cited above, that had F. Gomes Teixeira as a foreign member of its permanent commission headed by H. Poincaré, is *O Instituto*, a scientific and literary publication that the University of Coimbra started in 1853. This was not a mathematical journal, although some of the lecturers and professors of Coimbra published a few mathematical papers in it [CS], mainly for didactic purposes and of little interest as research contributions. As observed by Luis Saraiva in [S], "in spite of the pioneering reform of 1772, the Mathematics Faculty of Coimbra University did not have a significant influence on the progress of mathematics in Portugal during the first three-quarters of the 19th century", and this journal reflects that situation. Nevertheless, at least one exception should be mentioned: the re-publicatiion in 1856 (vol. 4, pp. 212-14, 222-23, 236-38) of the *Ensaio sobre os Principios de Mechanica,* by José Anastácio da Cunha (1744-1787). In this remarkable essay, written by the former professor of the University during the last years of his life as a teacher of the *Casa Pia,* in Lisboa, we can find a pioneering distinction between rational mechanics and physical mechanics by means of an axiomatic separation of kinematics from dynamics with mathematical postulates in the former, in contrast with the experimental requirements for the later (see [Ro] for a further analysis).

The *Jornal de sciencias mathematicas e astronomicas*

Although mathematical research in Portugal was very limited, there were a few cases of original contributions that were rediscovered and not acknowledged. We may consider that this was basically due to limitations of language and to the isolation and peripheral role of the Portuguese University and Academy. In the middle of the second half of the 19th century, a partial recognition of this situation can be found in the *Memoria Historica da Faculdade de Mathematica* (Coimbra, 1872, pp. 49-50), written by Francisco de Castro Freire, who noted the urgency of international exchanges (*commercio litterario*), as observed in [CS].

In 1877 Francisco Gomes Teixeira founded the *Jornal de sciencias mathematicas e astronomicas,* which, although published by the University of Coimbra Press, was the first mathematical journal in the Iberian world independent of any academic institution. This *Jornal* was published regularly in 15 volumes until 1902 and had the specific aim of ending Portugal's mathematical isolation and enhancing direct contact with mathematicians from other countries. As observed in [S], it also reflected a significant increase of mathematical activity by Portuguese mathematicians as quantified by the number of mathematics works in the last quarter of the 19th century, compared to the previous quarter: for each five-year period the average of 32, of which an average of 17 were issued in journals, rose to an average of 107, including an average of 79 in journals.

F.G. Teixeira (1851-1933) did a doctorate on second order partial differential equations in 1875 at the University of Coimbra. There he became a professor in 1879 before moving in 1883 to the *Academia Politécnica do Porto,* the forerunner of the Faculty of Sciences of Porto University, which was created in 1911 and where he was Rector until 1929. Author of a remarkable *Course of Differential and Integral Calculus* (volumes III and VI of his *Works*, respectively of 1906 and 1912, but already in use for two decades) and the classic *Treatise of Special Curves* (volumes IV, V and VII of his *Works*, respectively of 1908, 1909 and 1915, the first version of which was awarded a prize in 1899 by the Royal Academy of Sciences of Madrid), F.G. Teixeira published more than 140 mathematical articles. The most significant papers were published in the best-known journals, like Crelle's and Liouville's, and may be found in the first two volumes of his *Works*, published in 1904 and 1906 by the Portuguese government.

The first issue of *Jornal de sciencias mathematicas e astronomicas* opens with an article by F.G. Teixeira himself, *Sur la decomposition des fractions rationnelles*, developing the decomposition of rational functions in simple elements. In the first volume of about 180 pages there are research articles and notes, including a section for secondary level mathematics with the aim of attracting contributions from high school teachers. However, this component was unsuccessful and was later abandoned, and it became a scientific journal for research papers and notes only. In that first issue of 1877, we can find contribution by the leading French mathematician C. Hermite, *Sur les formules de Mr. Frenet*, in which he presents in a simpler form the differential equations to determine a curve given its curvature and torsion radii. It is also interesting to find in the first issue a letter from Daniel da Silva to M. Moigno on the priority of his results on the composition and reduction of forces of his memoir of 1851.

The majority of the authors were Portuguese mathematicians, including, besides Teixeira himself, F. da Ponte Horta, J.A. Martins da Silva, D.L. Pereira da Silva, J. Bruno de Cabedo and R. Guimarães. However, the international recognition of Teixeira's works, as well as his copious correspondence with many reputed mathematicians of his time, notably C. Hermite, M. D'Ocagne, E. Cesaro, G. Loria, and C. De la Vallée Poussin, attracted articles by these authors to the *Jornal de sciencias mathematicas e astronomicas.*

For instance, we can find extracts from letters to Teixeira in French in volume VI (1885) by Hermite "On the Legendre polynomials", and in volume VII (1886) by E. Cesaro with "Remarks on the theory of series", as well as short articles, like the *Nota su due applicazioni algebriche dell'eliminazione*, by G. Loria, in volume IX (1889) and the *Note sur les series dont les termes sont functions d'une variable complexe,* by C. De la Vallée Poussin, in volume XI (1892). It is also interesting to note that the titles of the articles of "Teixeira's journal" were regularly included in *Le repertoire bibliographique des sciences mathématiques* and in the *Jahrbuch über die Fortschritte der Mathematik*.

In 1905, three years after the publication of the fifteenth and last volume of his *Jornal,* Teixeira founded the *Annaes Scientificos da Academia Polytechnica do Porto,* an institutional journal that widened its scientific scope beyond mathematics, covering also physics, chemistry and natural sciences. For mathematics, the new journal replaced the old *Jornal de sciencias mathematicas e astronomicas,* as Teixeira explicitly stated in the foreword note in the first issue, formulating the hope "that the geometers who collaborated in this journal will honour the new journal with their works"

In the first few years, the majority of papers published in the *Annaes* were in fact by Portuguese and foreign mathematicians, not only from Europe but also for the first time from Japan. It is interesting to note that among the famous mathematicians who honoured the *Annaes* with their papers, we can find a memoir by P. Appell in volume IV (1909) on *Quelques remarques sur les équations du movement d'une chaine parfaitement flexible*, among other notes by this French mathematician, the article *Über die Zahlen mit einer gegebenen Teilerankahl,* by E. Landau in volume VI (1910), and the note *Sur les systèmes linéaires, a deux inconnues, admettant une intégrale quadratique* by M.T. Levi-Civita in volume VII (1912).

The *Annaes*, which had been printed by the Coimbra University Press since the first volume, changed its name to *Anais da Faculdade de Sciências do Porto* in volume XV (1927/28) and began to be printed in Porto by *Imprensa Portuguesa*. It continued to be published under the direction of F. Gomes Teixeira until his death, in 1933, and remained the main scientific journal in Portugal publishing research papers in mathematics for another decade. In the 1920s and 1930s we can find there some papers by J. Vicente Gonçalves and A. Almeida Costa, and also the doctoral thesis of António Monteiro, presented in July 1936 at the University of Paris under the supervision of M. Fréchet, *Sur l'additivité des noyaux de Fredholm*, published in volume XXI (1936).

The *Portugaliae Mathematica*

António Aniceto Monteiro (1907-1980) was the young forerunner of mathematical modernism in Portugal, advocating socially modernized professional and autonomous mathematical activity in a well-known passage written in 1942: "It is unquestionable that we see today in our country a veritable effervescence of activities in the field of mathematical sciences. This is shown by the successive appearance, in the short period of five years, of: 1) *Portugaliae Mathematica*, founded in 1937; 2) *Seminário Matemático de Lisboa* (1938), which changed its name to *Seminário de Análise Geral* in November of 1939; 3) *Centro de Estudos de Matemáticas Aplicadas à Economia*, founded by the 1st group of the *Instituto Superior de Ciências Económicas e Financeiras* (1938); 4) *Gazeta de Matemática*, January 1939; 5) *Centro de Estudos Matemáticos de Lisboa*, founded by the *Instituto para a Alta Cultura*, in February of 1940; 6) *Sociedade Portuguesa de Matemática*, December 1940; 7) *Centro de Estudos Matemáticos do Porto*, founded by the *Instituto para a Alta Cultura*, in February of 1942." [M]

While *Gazeta de Matemática* was founded as an intermediate journal aimed at mathematical students and teachers, Monteiro created *Portugaliae Mathematica* as a research journal with the explicit purpose of contributing to the development of mathematical studies in Portugal, to archive all Portuguese works that were unpublished or included in national and international journals. It also had the aim of reflecting the mathematical movement in the country, and of contributing towards international cooperation in the field. In a certain sense, we may regard the new journal as a modern version of Teixeira's *Jornal,* which has been created sixty years earlier and no longer existed.

Portugaliae Mathematica opened its first issue with the 174 pages of Monteiro's thesis, reprinted in 1937 by the same *Imprensa Portuguesa* in Porto, and it is interesting to observe a slight change in its acknowledgements, where the reference to *"le peuple de notre pays"* is omitted*,* reflecting the political constraints of the country at the time. The first volume was completed only in 1940 with the financial support of the *Instituto de Alta Cultura (I.A.C.),* at the recommendation of Pedro José da Cunha [Ri], a retired professor of the Faculty of Sciences of Lisboa and first president of the newly created Portuguese Mathematical Society (SPM). The first editorial committee was composed of a group of young and enthusiastic mathematicians, José da Silva Paulo, Hugo Ribeiro and Manuel Zaluar Nunes, who became in fact director from 1945 until 1967, replacing António Monteiro after his departure to Rio de Janeiro for political and financial reasons. The editorial committee, which also then included Ruy Luis Gomes from Porto University, shared Monteiro's vision of transforming *Portugaliae Mathematica* into a "true organ of Portuguese mathematical culture", but History has seen this journal also as a remarkable example of intellectual resistance to the oppressive environment of indifference and the repression of the dictatorship.

The complete volume I had two parts, the first being dedicated to original papers, with 346 pages, and consisted of an interesting blend of articles by young researchers, such as Monteiro himself, Ruy Luis Gomes, Hugo Ribeiro, and José Sebastião e Silva, from Portugal, and Caius Jacob from Romania, together with a few notes by the established mathematicians J. Vicente Gonçalves (1896-1985) and A. de Mira Fernandes (1884-1958), who supported the new journal by allowing reprinting of his papers in Italian from the *Rend. Ist. Lombardo di scienze e lettere* (LXXII, 1938) and the *Rendiconti Accad. Lincei* (Roma, XXVII, 1938). Its contents, as well as those of the following volumes, included several contributions from the small group active in Lisboa around Monteiro, in the *Seminário de Análise Geral* (1939-42) [CF], solving some questions proposed in Fréchet's book *Les espaces abstraits et leur théorie consideré comme introduction à l'Analyse générale*, published in Paris in 1928. Here the expression "general analysis" stands for the modern synthesis between classical and functional analysis, a research programme for these young mathematicians.

The second part of volume I had 137 pages and included a reprint of Mira Fernandes' notes published between 1928 and 1936 in the *Rendiconti della R. Academia dei Lincei*, a practice that ended in the following volume, which still included three reprinted notes by other

Portuguese mathematicians. This second part also had a report on the International Congress of Mathematicians held in 1940 in Cambridge, USA, and a detailed list with bibliographical information of the journals obtained by exchange with *Portugaliae*. Due to the poor conditions of Portuguese mathematical libraries, this was one of the main contributions of the new journal and it is worth noting that during the initial period of its organization in 1937-40, there were 116 titles obtained by exchange, 10 being from both the USA and the USSR, 9 each from Italy, Japan, Poland and Germany, 8 from both the UK and Romania, 7 from India, 6 from Belgium, etc. In 1990, after the reorganization of the *Portugaliae Mathematica* library carried out in the 1980s at the *Centro de Matemática e Aplicações Fundamentais(CMAF)*, hosted by the University of Lisboa, the total number of exchange journals was 143 [PG].

Volume II of *Portugaliae* still had a majority of contributions by Portuguese authors, including a 70 page memoir by Pedro José da Cunha and the article *Sur une méthode d'approximation semblable à celle de Gräffe*, with an interesting new numerical algorithm by J. Sebastião e Silva, written while he was a young I.A.C. research fellow at the *Centro de Estudos Matemáticos de Lisboa*. This topic was developed in Rome, where he published two notes on it in *Rend. Accad. Lincei* in 1946. As observed in [CF], in the paper *Generalization of an algorithm of Sebastião e Silva*, published in 1971 in *Numerisch Mathematik* [MR 44#2332], A.S. Householder praised and developed the theory introduced in that paper of 1941, which was included in the recent extensive review [P] of some of the 20th century algorithms for finding polynomial zeros.

The third and last volume of *Portugaliae* sponsored by the I.A.C., in 1942, opened with a long paper of 62 pages by John von Neumann, on *Approximative properties of matrices of high finite order*, and as part of an increasingly international collaboration, we can find a paper by Maurice Fréchet and another by R. Cacciopoli. In spite of the international recognition of the journal, the fourth volume, corresponding to the years 1943/45 and containing articles by G. Ascoli and H. Hopf, as well as the subsequent volumes of *Portugaliae Mathematica,* were published without any financial support from the state, a situation that continued until the reorganization at the end of the 1970s, under the new democratic regime. Financial support came mainly from the *Junta de Investigação Matemática* (J.I.M.) and the Portuguese Mathematical Society (SPM). The J.I.M. was a remarkable private association created in 1943 by the initiative on Ruy Luis Gomes, professor at the Faculty of Sciences of Porto, in association with Mira Fernandes and António Monteiro. They had the aim of promoting mathematical research and sponsoring publications, fellowships and international missions of Portuguese mathematicians, a role that I.A.C. was unable to fulfil adequately [LG].

The list of contributors to the first twenty-five volumes of *Portugaliae*, under the direction of Zaluar Nunes from volume 5 (1946) until his death in 1967, contains the names of all the important Portuguese mathematicians active in those three decades, but one should also mention at least one exception, the algebraist A. Almeida Costa (1903-1978). Of these authors, some published several articles, like Sebastião e Silva who, in volume 9 (1950), published his thesis, presented at the Faculty of Sciences of Lisboa in 1948. Within the long list of international collaborations we can find the names not only of distinguished mathematicians such as the already mentioned M. Fréchet, J. von Neumann, R. Caccioppoli, G. Ascoli and H. Hopf, but also of W. Sierpinsky (vol. 5 and 15), L. Nachbin (vol. 6), L. de Broglie and P. Erdös (vol. 8), I. Kaplansky and M. Peixoto (vol. 10), J. Dieudonné (vol. 11 and 14), G. Köthe (vol. 13), C. Foias and J.-L. Lions (vol. 19).

The *Revista da Faculdade de Ciências da Universidade de Lisboa*

Following the example of Porto University, in 1931 there appeared the first volume of the *Revista da Faculdade de Ciências da Universidade de Coimbra*, starting with an article by the physics professor Mário Silva. Although it was intended to cover all the disciplines of the Faculty of Sciences, the first note on mathematics only appeared in volume 4, and with very few exceptions there are virtually no significant mathematical papers until the 49th and last volume in 1974. Possible exceptions include two notes by J. Vicente Gonçalves, published in

volumes 9 and 19 of 1941 and 1942, respectively, and a long memoir by Graciano de Oliveira in volume 41 (1968).

The Faculty of Science of the University of Lisboa, as part of the commemorations of the centenary of the *Eschola Polytechnica de Lisboa,* of which it was the continuation after 1911, also decided in 1937 to begin publishing a *Revista*. The first series of the *Revista da Faculdade de Ciências da Universidade de Lisboa* published only four volumes until 1949, with some expository works by professors and news of the school without any mathematical papers. The anti-intellectual offensive of the Portuguese dictatorship in 1947, which expelled from the University and the country several scientists and professors, created an oppressive and retrograde cultural atmosphere. This, in particular, dramatically affected the development of mathematical sciences in the country for the next three decades. In spite of this, in 1950 J. Vicente Gonçalves (1896-1985) created the *2nd series A (Ciências Matemáticas)* of the *Revista da Faculdade de Ciências da Universidade de Lisboa.* Coming from the University of Coimbra in 1942, where he had studied, completed a doctoral degree in 1921 and had became professor in 1927, J.V. Gonçalves was a fine and profound mathematician and he left many original contributions in classical analysis, in the spirit of the previous century.

The second series of the *Revista da Faculdade de Ciências da Universidade de Lisboa* had three sections (Section A – *Ciências Matemáticas*; Section B – *Ciências Físicas e Químicas* and Section C – *Ciências Naturais*), and by 1961 had established a significant list of exchange journals of the same kind with over six hundred titles from over fifty countries. Although Section A published only 14 volumes and lasted only until 1972, it became a mathematical journal worthy of note, since it published several doctoral theses and papers by Portuguese mathematicians who were active in Lisboa during the period. However, it attracted only a few minor contributions from foreign authors.

The first article of the new mathematical *Revista* was on *Trasporti Finiti* by A. de Mira Fernandes, since 1911 professor of mathematics at the *Instituto Superior Técnico* (the capital's new engineering school), in which the author described and developed the Einstein-Bergmann theory of bivector fields. Mira Fernandes contributed regularly to this journal with ten articles on differential geometry until his death in 1958, all written in Italian, the language in which he published his research work and corresponded with Levi-Civita in the late 1920's and the 1930's.

Among the several professors of mathematics of the Faculty of Sciences of Lisboa who published in its *Revista,* in addition to Vicente Gonçalves himself (who contributed forty-four short articles and research notes, all but one in French), the other authors, by decreasing number of contributions, were J.J. Dionísio (with 19 articles in English and in Portuguese), J. Tiago de Oliveira (with 18 papers on algebra and statistics in English and in French), A. Almeida e Costa (with 15 articles on algebra in German and in French), and F. Dias Agudo (10 articles in Portuguese and in English).

Among the four articles by J. Sebastião e Silva in this journal, following G. Köthe [K], we should highlight the two memoirs *Sobre a topologia dos espaços funcionais analíticos* (in vol A 1, 1950, pp. 23-102) and *Sur une construction axiomatique de la théorie des distributions*, (in vol. A 4, 1954/5, pp. 79-186), as important contributions to the development of functional analysis at the beginning of the second half of the 20th century. In the first on the topology of analytic functional spaces, Sebastião e Silva developed, in particular, an integral representation for continuous linear operators on a space of holomorphic functions, in the framework of Fantappiè's theory of analytical functionals contributing to the theory of topological vector spaces. In the second memoir, recognizing the importance of L. Schwartz's theory of distributions published in 1950, Sebastião e Silva developed a different point of view, proposing direct definitions of the notion of distribution and of the topology in the space of distributions. In particular, he established some results that later led him to the study of a remarkable class of locally convex spaces, which are the inductive limit of an increasing

sequence of normed spaces in which the closed ball of one space is always relatively compact in the next one, and which became known as Silva spaces (see [K] for further references).

Portugaliae Mathematica with the Portuguese Mathematical Society

From 1967 until the reconstruction of the the *Sociedade Portuguesa de Matemática* (SPM) in 1976/77, *Portugaliae Mathematica* continued its publication from volumes 26 to 35 as an internationally recognized mathematical journal, although with hardly any contributions from Portuguese mathematicians. Without any refereeing system, it lost quality and publication became irregular later, partly due to the difficult cultural and scientific conditions in Portugal. When the country returned to democracy in 1974, *Portugaliae* appeared under the direction of José Gaspar Teixeira, who became the publisher of *Gazeta de Matemática* and director of *Tipografia de Matemática*, after the death of Zaluar Nunes. But this publisher, whose name appeared as director from 1973 until the beginning of 1977, was isolated from the mathematical research community, and so was unable to re-establish the normal standards of a scientific publication. As a typical example, after a first incorrect paper with a false "general proof of Fermat's last theorem", by a certain Q.A.M.M. Yahya from Pakistan, included in volume 32 (1973), was recognized by *Mathematical Reviews* as relying on a wrong result of 1933 by the German mathematician Kapferer, the same author succeeded in publishing two more notes on the same famous topic in the volumes of 1976 and 1977 (first issue), respectively.

The "moral donation" by António Monteiro of the title of *Portugaliae Mathematica* to the SPM and its official registration by the Society in December 1978 was needed to establish the conditions for the recovery of its international credibility. A protocol of July 1982 recognized the constitution of a new Editorial Committee composed of Alfredo Pereira Gomes, João Paulo Dias, Maria Luisa Galvão (and later Luis Sanchez), all from the University of Lisboa, and Graciano Oliveira, from the University of Coimbra. This committee established a normal refereeing system for the evaluation of submitted papers, with the advice of an Editorial Board with Portuguese and several distinguished foreign mathematicians.

It took some years, from volume 36 onwards, for its publication to became regular again. That volume, corresponding to the year 1977, with the exception of the first issue, was published under the new Editorial Committee only in October 1980, with the financial support of the Calouste Gulbenkian Foundation. The *Portugaliae* library was re-established with a renewed list of exchanges with similar journals, following a protocol of 1983 with the *Centro de Matemática e Aplicações Fundamentais* (CMAF), the mathematical research centre created in 1975 with the support of INIC, the National Institute for Scientific Research, resuming the old tradition of the *Centro de Estudos Matemáticos de Lisboa*. This agreement for mutual support of mathematical libraries was confirmed in 1991 with CMAF, and, after the abolition of INIC at the end of 1992, it continued to be hosted by the *Complexo Interdisciplinar* at the University of Lisboa.

At the initiative of A. Pereira Gomes, who directed *Portugaliae* during 1978-95, and the guidance of the new Editorial Committee, volume 39, corresponding to the year 1980, appeared a few years later, again with support from the Calouste Gulbenkian Foundation, and was published in honour of the memory of its founder, just deceased at the age of 73, in Bahia Blanca, Argentina, where he had lived for many years. This volume, in addition of pages I-XLI, in which friends and colleagues wrote on aspects of his life, work and personality, and 24 original papers in his honour (10 others were included in volume 40), also includes his 237-page memoir *Sur les Algèbres de Heyting symétriques,* which was awarded the 1978 Gulbenkian Science prize and had been written in 1977/78, during Monteiro's two-years stay in Lisboa at CMAF, as visiting researcher of INIC.

Also at the beginning of the 1980s, during the process of normalizating publication, *Portugaliae* dedicated a special volume, the 41st, corresponding to 1982, to José Sebastião e Silva, the most significant Portuguese mathematician of the 20th century. He published nine papers in this journal between 1940 and 1960. This volume brought together 42 papers, presented at

the international *Symposium on Functional Analysis and Differential Equations* held in Lisboa, in that year, in honour of the distinguished Portuguese analyst. This reflected the new atmosphere and internationalization of the renewed mathematical community at the dawn of Portugal's integration in the European Union.

With its fiftieth anniversary, the publication of volume 47 in 1987 demonstrated the editorial stability of the journal, which had by then recovered its international acceptance and was again attracting the collaboration of Portuguese mathematicians. With the financial support of INIC, this volume also initiated a new era in its publication, since for the first time it was electronically composed in TEX at CIISA *(Centro de Informática do Instituto Superior de Agronomia).* From 1996 on, TEX composition has been partially supported by CMAF and *Centro de Álgebra*, as well as by the other mathematical research units of the University of Lisboa, the financial situation of *Portugaliae* being stable*,* due to the number of its subscriptions and additional support from the *Fundação para a Ciência e Técnologia*.

During World Mathematical Year (WMY2000) and the turn of the century the Editorial Committee was composed of six members from the Universities of Lisboa and Coimbra, under the direction of João Paulo Dias, and the Editorial Board of 31 members was composed of 15 Portuguese mathematicians, including two living abroad, and 16 other foreign members. Among these, three were from the USA, one from Brazil and the other 12 from European countries. The electronic edition of *Portugaliae Mathematica* also integrated *The Electronic Library of Mathematics,* starting with volume 51 (1994) with a "window" (i.e. a delay in electronic publication) of three years with respect to the printed version, under an agreement with the European Mathematical Society (EMS). A list of contents of all the published volumes could already be found on the journal's website: *http://portmath.lmc.fc.ul.pt/volumes.html*

At the dawn of the 21st century, mathematicians have been discussing for some time the need to digitize the mathematical literature of the past. Although the last volumes of *Portugaliae Mathematica* already integrate the beginnings of a virtual library, and it is currently also available in electronic form, it remains to retro-digitize not only the earlier volumes of the sole Portuguese mathematical journal currently existing, but also to start a national digitization programme for the rest of the scientific heritage briefly surveyed here, for which there exists a comprehensive survey up to the year 1900 in [G], with a view to its integration in a future *Digital Mathematical Library.*

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