Fabio Conforto (1909–1954): His Scientific and Academic Career at the University of Rome

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Abstract The mathematician Fabio Conforto (1909–1954) played a significant role in the framework of the historical research about the Italian school of algebraic geometry in the decades before, during, and after WWII. The 1930s of the twentieth century represent the year of Conforto's scientific maturation. During the 1940s, Conforto, besides the difficult war experience, achieves his national and international success. He was professor of analytical and descriptive geometry at the University of Rome, he kept lectures at INdAM, and he was one of the most brilliant collaborators of Mauro Picone inside the INAC.

Unfortunately, Conforto's untimely death suddenly interrupted his professional career. In this work, we want to outline a scientific biography of Conforto in the light of his varied mathematical production.

Keywords Fabio Conforto · Italian school of algebraic geometry · Collaboration with INAC and Mauro Picone · Lectures at INdAM

1 Introduction

> Fabio Conforto gave a lot to his students, university, and science, with his deep and many-sided work in the most different fields of scientific research and teaching.[1]

[1] *Molto ha dato Fabio Conforto ai suoi allievi, alla scuola, alla scienza, con la sua intensa e multiforme opera nei campi più diversi della ricerca scientifica e dell'insegnamento.* This is the testimony of Mario Rosati (1928–2018), who was a student of Conforto. Rosati commemorated his teacher on the occasion of the donation of the personal library of Conforto to the Library of the Department of Mathematics and Computer Science of the University of Ferrara (November 2008). See [72]. Rosati graduated with Conforto in Rome in July 1950 defending a thesis about "projective geometry of the abelian varieties." Rosati was assistant to the chair of geometry. He

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G. Bini (ed.), *Algebraic Geometry between Tradition and Future*,
Springer INdAM Series 53, https://doi.org/10.1007/978-981-19-8281-1_4

Fabio Conforto has been one of the most relevant figures of the Italian mathematical landscape in the difficult historical period that goes from the 1930s to the beginning of the 1950s of the twentieth century. Besides the educational activity inside the University of Rome, Conforto carried out a significant research activity in the field of algebraic geometry but also of the study of applied mathematics. He was in fact one of the collaborators of Mauro Picone (1885–1977) at the National Institute for the Applications of Calculus (Istituto Nazionale per le Applicazioni del Calcolo, from now on INAC) and one of the professors of the National Institute of Higher Mathematics (Istituto Nazionale di Alta Matematica, from now on INdAM), managed by Francesco Severi (1879–1961). During his life, Conforto collected a wide selection of books and scientific papers that ranged from pure to applied mathematics, without neglecting works about logics, philosophy, and foundations. Conforto's collection of books and papers reflects his multiple interests and represents a useful instrument for reconstructing his scientific biography.[2] In this work, we are going to point out the most relevant events of Conforto' short but intense academic career in Rome.

2 Early Career of Conforto

Fabio Conforto was born on 13 August 1909 in Trieste, which at that time was part of the Austro-Hungary Empire. Soon after his birth, his family moved to Vienna. Conforto's parents were Italian speaking, so at home, the young Fabio spoke Italian. When he began attending elementary school, he learnt to speak, read, and write in German. His bilingualism would be very useful for Conforto after some years.[3]

Conforto spent the first 10 years of his life in Vienna. After the end of WWI, Conforto's family returned to Trieste, where Fabio completed his secondary education. He attended the Gymnasium, and then he completed his schooling at scientific high school (*Liceo Scientifico*), undertaking the work of the final 2 years in a single year and taking the State Examination 1 year early.

In 1926, Conforto entered the Faculty of Engineering at the Polytechnic University of Milan. Oscar Chisini, who was one of his teachers at the Polytechnic, immediately recognized Conforto's mathematical inclination and suggested him to

also attended the lessons given by Severi and Conforto to INdAM. In 1966, Rosati won the chair of geometry in Padua.

[2] In 2008, Conforto's heirs gave the collection of books and papers, belonged to Fabio Conforto, to the Library of the Department of Mathematics and Computer Science of the University of Ferrara. This is a particularly rich collection: it contains more than 700 books and about 2600 scientific papers. The volumes of the *Fondo Conforto* have been catalogued and can be found in the national OPAC catalogue. The cataloguing work of the scientific papers is still in progress.

[3] Conforto's biographical references can be found in [3, 6], and [73].

devote himself to pure mathematics, instead of practical applications.[4] So Conforto was discharged from the Milan Polytechnic in order to go to the University of Rome, and in the autumn of 1928, he and his family moved to Rome, which was going to become his second "native land."[5]

3 Fabio Conforto in Rome

When Conforto arrived in Rome, the city was one of the most important centers as regards mathematics. Thanks to the presence of mathematicians like Guido Castelnuovo (1865–1952), Federigo Enriques (1871–1946), Vito Volterra (1860–1940), and Tullio Levi-Civita (1873–1941), the program of the so-called *Rome of scientists*—conceived since 1870 by Luigi Cremona (1830–1903) and Quintino Sella (1827–1884)—was going to be pursued, despite the difficulties. Castelnuovo was called to Rome in 1891 to become full professor. At the beginning of his Roman period, he met Enriques, who had just graduated at the *Scuola Normale Superiore* in Pisa and had moved to Rome to attend Cremona's courses. Castelnuovo oriented Enriques' study toward algebraic surfaces.[6] After the end of WWI, the Italian school of algebraic geometry was growing, and Rome represented the main site.[7] Besides Castelnuovo, the leading representatives were Enriques and Severi, who were called to Rome in 1921.[8]

Conforto's scientific education was carried out in Rome since the end of the 1920s. In the autumn of 1928, Conforto entered the University of Rome where he

[4] Oscar Chisini (1889–1967) graduated in Mathematics at the University of Bologna in 1912 under the supervision of Federigo Enriques. Chisini, who has obtained the lecturing post in 1918, was professor of algebra and analytical and projective geometry at the University of Milan since 1925. During his stay in Milan, Chisini also held the chair of analytical and projective geometry at the Polytechnic University. See [66].

[5] In Conforto's dossier that is preserved at the Archive of Milan Polytechnic, we can read: *Ingegneria Congedato in data 23 novembre 1928 per Regia Università di Roma*. See http://www.archimistaweb.polimi.it/groups/Polimi-ArchiviStorici.

[6] See [7, p. 25] and [69].

[7] In the first decades of the twentieth century, many students (both from Italy and from abroad) came to Rome in order to study mathematics. Thanks to the Rockefeller Foundation, many foreign students came to Italy as scholarship. In September 1924, funded by a Rockefeller fellowship, Dirk Struik (1894–2000) spent 9 months in Rome, working with Levi-Civita. Oscar Zariski (1899–1986) took a Rockefeller fellowship in Rome during the years 1925–1927. Alexander Weinstein (1897–1979) was Rockefeller bursar in Rome in 1926–1927, Harald Geppert (1902–1945) in 1928–1929, and Paul Dubreil (1904–1994) in 1930–1931 (with Enriques). See [77, p. 200] and also [68, p. 102].

[8] Enriques spent more than 20 years (1894–1921) in Bologna, where he was called to teach projective and descriptive geometry. Then he moved to Rome to teach complementary mathematics and, since 1923, also higher geometry. Enriques' period in Bologna is described in [61]. In 1921, Severi arrived in Rome to teach in the chair of algebraic analysis.

attended lectures by Tullio Levi-Civita, Guido Castelnuovo, and Federigo Enriques. Conforto was particularly influenced by the lectures of higher mechanics of Vito Volterra.

Following Volterra's theories, Conforto's first works, appeared in 1930 and 1931, dealt with absolute differential calculus in a continuous function space. The three works, prepared under Volterra's guidance, were presented by Volterra in the reports of the Accademia dei Lincei.[9] In the period July–September 1930 and 1931, Conforto attended the cadet school in the city of Lucca. Here he met the physicist Gilberto Bernardini (1906–1995), who was assistant of Giuseppe Occhialini (1907–1993) in the chair of physics at the University of Florence. Conforto graduated in pure mathematics at the University of Rome *summa cum laude* on 3 July 1931.[10]

Soon after the degree, Conforto obtained a scholarship of £8000, supported by the National Research Council, in order to spend a period of study at the University of Göttingen, in Germany. Conforto stayed in Göttingen from January to June 1932. Thanks to his bilingualism (Italian and German), he could benefit and be influenced by two different mathematical ways of study.[11] In Göttingen, Conforto could deepen his research in the field of geometry in a continuous function space. In this subject, he prepared a complete exposition of the absolute differential calculus in continuous function space.[12] Conforto could also devote himself to items related with physical mathematics. He dealt with the problem of impulses in elastic isotropic bodies.[13]

When he came back to Italy, Conforto fulfilled military obligations, as second lieutenant of artillery, and he was attached to the 13th Artillery Regiment and stationed in Orvinio, near the city of Rieti, during the months of July and August 1932.

The 1930s of the nineteenth century marked the beginning of Conforto's scientific growth. After a further period of study and training at the *Fondazione Beltrami*, since the academic year 1933–1934, Conforto began his teaching activity at the University of Rome. He initially was temporary assistant (*assistente incaricato*) of Guido Castelnuovo in the chair of analytical and descriptive geometry. Then, in October 1934, Conforto competed for an assistant position for the chair of analytical

[9] See [9, 10], and [11].

[10] *Il sottoscritto ha conseguito nella sessione di luglio dell'anno 1930–1931 presso la Regia Università di Roma la laurea in Matematica pura, ottenendo il massimo dei punti e la lode*. This testimony was given by Conforto in a letter (Rome, 10 November 1931) to the Mathematical Commission of the National Research Council (CNR). See http://media.accademiaxl.it/pubblicazioni/Matematica/link/conforto.pdf.

[11] In some letters written to Enrico Bompiani, Conforto described the rather different approach to mathematics in Germany as compared to Italy. These letters are kept in the *Fondo Bompiani* of the *Accademia Nazionale delle Scienze* (*Accademia dei XL*) in Rome and can be freely consulted online. See http://media.accademiaxl.it/pubblicazioni/Matematica/link/conforto.pdf.

[12] The paper was published in the Annals of the Normale Superiore di Pisa, Science Class. See [14].

[13] Thanks to Tullio Levi-Civita, Conforto published the results of his discoveries in the reports of the Accademia dei Lincei: see [12] and [13].

and projective geometry. Conforto won the competition and gained the assistant position. He was tenured assistant (*assistente di ruolo*) in the chair of analytical geometry from the academic year 1934–1935 to the academic year 1938–1939. Conforto's educational activity was always very appreciated, as it is confirmed in the report of the Exam Commission: "Brilliant and very precise speaker, completely familiar with the subject, he was able to confidently guide students' knowledge."[14]

After Castelnuovo's retirement (1935), Conforto became Enrico Bompiani (1889–1975)'s assistant in the same chair. In Rome, Conforto was also in touch and strongly influenced by the geometers Federigo Enriques and Francesco Severi. Thanks to Enriques and Severi, Conforto approached algebra and algebraic geometry, which represented the new mathematical research fields.[15]

In January 1936, Enriques proposed Conforto as volunteer assistant for the chair of higher geometry. After having attended the lessons given by Enriques, Conforto collected them in the book *Le superficie razionali*, which was published some years later in 1939.[16] The handbook was intended for university students of mathematics, and it can be considered a sort of "natural continuation" of the handbook *Teoria geometrica delle equazioni e delle funzioni algebriche* [63] by F. Enriques and O. Chisini, which is often quoted.[17]Conforto took inspiration from Enriques' lessons of higher geometry but also from the classical theorems by Luigi Cremona, Alfred Clebsch (1833–1872), and Eugenio Bertini (1846–1933), revised according to a more modern point of view.[18] As regards Conforto's original contribution, it dealt with some researches that he had published some years before and that he used for the writing of the handbook. He referred to two works about Halphen pencils (*fasci di Halphen*): one note about surfaces common to two families of rational quartics with double points, discovered by Noether (*superficie comuni alle due famiglie di quartiche razionali con punto doppio, scoperte da Noether*), a critical addition to the reduction of rational double planes (*complemento critico portato alla riduzione dei piani doppi razionali*), and one note about the bisection of the canonical series over entities of fourth genre (*la nota sulla bisezione della serie canonica sopra gli enti*

[14] *Durante il periodo predetto il Dott. Conforto ha svolto il suo lavoro con intelligenza, capacità e zelo. Espositore brillante e chiarissimo, perfettamente padrone della materia, di modi signorili che riflettono l'elevatezza dei suoi sentimenti, ha saputo ogni anno coltivarsi la simpatia delle numerose classi di studenti e guidare con sicurezza la preparazione*. Members of the Exam Commission were Guido Castelnuovo, Enrico Bompiani, and Mauro Picone. See Archivio Storico Università La Sapienza, *Fascicolo personale di Fabio Conforto*.

[15] Some problems related to the foundations of algebraic geometry began to be taken into account, especially by Severi. See [7, pp. 41-55].

[16] The handbook was republished in 1945 with the title *Le superficie razionali nelle lezioni del Prof. F. Enriques*. See [21] and [25].

[17] The work, whose first draft dated back to 1915, consisted of four volumes. It collected the main results in the theory of algebraic curves, presented from various points of view. See [7, p. 103].

[18] Another volume completed Enriques' trilogy of treatises devoted to the exposition and systematization of algebro-geometric knowledge, i.e., *Le superficie algebriche* [62], that was published posthumously in 1949. Such treatise reworked and extended an earlier edition compiled by Enriques in collaboration with Luigi Campedelli (1903–1978). See [7, p. 103].

di genere quattro).[19] Inside the handbook, at the end of some chapters, the reader can find wide and useful historical notes that prove Conforto's interest for historical aspects in the teaching of mathematics.[20] As regards the classification of the fourth-degree surfaces, he quoted international but also Italian works, starting from the second half of the nineteenth century: A. Cayley (1864), L. Cremona (1868), A. Clebsch (1868, 1870), M. Noether (1871), G. Darboux (1873), C. Segre (1884), G. Castelnuovo (1894), H. Mohrmann (1923), and G. Gherardelli (1936).

3.1 Conforto at INAC

During the 1930s, Conforto began to collaborate with INAC. The Institute, originally founded by Mauro Picone in Naples (1927), was later moved to Rome, where it began its scientific activity in October 1933.[21]

> The Institute is a scientific institution able to subsidize the experimental sciences and the technique, in the quantitative mathematical analysis of their problems. It carries out its research aimed at perfecting or creating mathematical analysis methods that respond to the fulfillment of the aforementioned task. Upon request, it provides study, collaboration and consultancy services for mathematical investigations in various applications, including industry.[22]

At the Institute, mathematical applications were studied in order to try to solve concrete problems, i.e., problems about aerodynamics, elasticity, and building science. As a consultant of the Institute, Conforto was involved in such kind of studies, also in collaboration with other researchers. Together with Tullio Viola (1904–1985), Conforto dealt with the numerical solution of a seismology problem, which was proposed by the geodynamic observatory of Padua (1936).[23] Other topics were the vibration of aircrafts (1937)[24] and the elastic deformation of a

[19] Conforto [21, p. VIII]. The papers quoted by Conforto are [15–17, 19], and [20].

[20] In the handbook, it's clear Enriques' influence on Conforto, not only for the writing of the handbook but also for the importance given by Conforto to the history in the teaching of mathematics. According to Enriques, historical notes have an important didactic role because they represent an instrument that helps students to understand better the origin of mathematical disciplines but also the main concepts and their genesis. As a consequence, history of mathematics is not to be seen only as a rigid succession of events but also as a key to understand achievements. See [65].

[21] In 1932, Mauro Picone was called at the University of Rome in the chair of higher analysis, in the place of Vito Volterra, who refused the oath of allegiance to fascism.

[22] *L'Istituto per le Applicazioni del Calcolo è un organo scientifico atto a sussidiare le scienze sperimentali e la tecnica, nell'analisi matematica quantitativa dei loro problemi. Compie ricerche proprie rivolte al perfezionamento od alla creazione di metodi di analisi matematica rispondenti all'adempimento del sopradetto compito. Fornisce, su richiesta, opera di studio, di collaborazione e di consulenza, per le indagini matematiche nelle varie applicazioni anche industriali*. See [67, p. 89].

[23] Conforto and Viola [59].

homogeneous and isotropic dihedron (1941).[25] This last research solved a problem related to the fixing of great lenses, which was proposed by the National Optical Institute of Florence.

One of the Institute's activities was the preparation of a handbook for the calculus of a continuous flexed beam subject to an axial thrust. The handbook, written by Conforto jointly with Lamberto Cesari (1910–1990) and Carlo Minelli (1898–1954), was prepared for aeronautical constructions.[26] All these works, despite the evident theoretical part, gave also important practical contribution and proved the close connection between technology and pure science.

3.2 The Scientific Relationship with Francesco Severi

When, in the autumn of 1936, Conforto obtained a lecturing post (*libera docenza*) in analytical geometry with elements of projective and descriptive geometry with drawing at the University of Rome, he was going to almost definitively orient his scientific interest toward algebraic geometry. This scientific tendency was stimulated by the presence at the University of Rome of Guido Castelnuovo, Federigo Enriques, and, most of all, Francesco Severi, to whom Conforto got closer.

In those years, Severi became the main reference point for Italian school of algebraic geometry. Conforto attended the lessons about algebraic varieties given by Severi from the a.a. 1936–1937 until 1940–1941, first at the University of Rome and later at INdAM.[27]

During the 1930s of the twentieth century, Conforto's academic career developed along different directions, not only inside the University of Rome but also at INdAM. Since 1939, Conforto was regular professor of analytical and descriptive geometry at the Faculty of Science of the University of Rome, together with Enrico Bompiani.[28]

From 1939, the year of its foundation, to 1953, Conforto taught many courses at INdAM on different topics about algebraic geometry: abelian functions, geometry of

[24] On this subject, Conforto published a paper, together with Carlo Minelli: [52]. Minelli was the link between the INAC and the Ministry of Aeronautics. Another work about the aircraft stress is [18]. These works proved Conforto's collaboration with the Ministry of Aeronautics.

[25] Conforto [23].

[26] Cesari et al. [8]. See [67, p. 120].

[27] All these lessons were collected by Conforto and Enzo Martinelli (1911–1999) and published in a volume: [74]. The treatise dealt with a systematic exposition of the theory of series of equivalence. The first volume appeared in 1942, and the other two volumes were published in 1958 and 1959.

[28] In his academic career, Conforto kept also the chair of history of mathematics (1938–1939), number theory (1940–1941, 1944–1945, 1945–1946, 1946–1947, 1947–1948), and topology (1950–1951, 1951–1952, 1952–1953, 1953–1954).

algebraic surfaces, and abelian modular functions.[29] Severi positively remembered Conforto's collaboration to the courses of INdAM.

> Fabio Conforto was one of our best colleagues at INdAM. He in fact began his collaboration at the moment the Institute began its life and its activities in the year 1939–40. Conforto's lessons represented a model of the teaching in an Institute aimed to information and scientific routing. They always contain a personal and re-elaborated version of theories and results of researches as well as recommendation of new problems for the researchers. I [Francesco Severi] remembered the international appeal that were gained by Conforto's courses, not only those that were published by the Institute, but also those, like a course about the theory of the automorphic functions, that have never been published.[30]

Conforto published a lithographed edition of his lessons about abelian functions and Riemann matrices (1942). The book *Funzioni abeliane e matrici di Riemann*, which reproduced Conforto's lessons held at INdAM in 1941, is divided into two parts: in the first one, the author developed the theory of abelian functions, generalizing a theorem stated by Appell in 1891. In the second chapter, Conforto established the links with algebraic geometry.[31] Another later volume of lessons on abelian modular functions (1951) was edited by his pupil Mario Rosati. In his exposition, Conforto followed on from previous development made by Carl Ludwig Siegel (1896–1981) and provided a reconstruction of all the subjects known at the time.[32]

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[29] Francesco Severi founded the National Institute of Higher Mathematics (INdAM) in 1939 (Legge 13 luglio 1939, n. 1129). Many students came to Rome in order to attend the lessons given at the Institute. See [71]. Conforto kept his lectures from 1939 to 1953, with some breaks due to WWII or to other academic tasks. The topic of his lectures were algebraic parametrically representable surfaces (a.a. 1939–1940), abelian functions and Riemann matrices (a.a. 1940–1941), particular classes of abelian functions (a.a. 1941–1942), issues related to the theory of abelian functions and to the rationality of varieties (a.a. 1942–1943), introduction to the theory of abelian functions (a.a. 1944–1945), geometry of algebraic surfaces (a.a. 1946–1947), abelian modular functions (a.a. 1950–1951, 1951–1952, and 1952–1953).

[30] *Fabio Conforto fu il primo fra i migliori dei nostri collaboratori all'Istituto di Alta Matematica. Egli infatti iniziò avanti di ogni altro la sua collaborazione con noi nel momento stesso in cui l'Istituto, nell'a. 1939–40, cominciò la sua vita e la sua attività. I corsi che egli professò presso l'Istituto di Alta Matematica costituiscono un modello di quello che può essere un insegnamento in un Istituto come il nostro, che ha un fine di informazione e di pretto istradamento scientifico. Essi contengono sempre una rielaborazione del tutto personale delle teorie e dei risultati di ricerche, che si può dire sono state fatte gradualmente nella immediata precedenza della esposizione, nonché indicazione dei problemi nuovi che si affacciano per i ricercatori. Ricordai [. . .] la risonanza internazionale che hanno avuto questi corsi. Ma non sono soltanto quelli che tutti possono conoscere attraverso le pubblicazioni dell'Istituto, giacché alcuni di pur notevole interesse, come un corso sulla "Teoria delle funzioni automorfe," Conforto non ha avuto mai la opportunità di pubblicarli* [6, p. 217].

[31] Conforto [24]. A review of the handbook can be found in [5]. The topic was broadly expanded in the work [49].

[32] Conforto [43]. The handbook *Funzioni abeliane modulari* collected the lessons given by Conforto at INdAM in the a.a. 1950–1951 and 1951–1952. The book was reviewed by Aldo Andreotti in [1]. Conforto would have liked to continue his editorial project with a second volume, but his premature death stopped it.

4 Conforto and WWII

The Italian political-military events soon intersected with the personal and professional ones of Conforto. After the outbreak of WWII (1 September 1939), Conforto was very soon called to arms with the rank of Lieutenant of Artillery and assigned to the First Regiment of Artillery of Foligno (16 November 1939). On 1 December 1939, he received the news that he won the academic competition for the chair of extraordinary professor of analytical geometry with elements of projective and descriptive geometry with drawing at the University of Rome. The chair was previously held by Gaetano Scorza (1876–1939).[33]

> Conforto's scientific work shows an original researcher, gifted with open-mindedness and suitable abilities to put them in place. The matters he poses himself have always a real interest and are always brilliantly carried out. [...] We can also add Conforto's deep knowledge with the most recent and highest fields of algebraic geometry, created by Severi, and the sharpness with which he knows how to pass from geometric matters to others of mathematical physics and analysis, bringing a precious set of knowledge that let him achieve the proposed purpose. Conforto's excellent teaching skills are known.[34]

Soon after the winning of the academic competition, Conforto was sent on leave on request of the University of Rome. There were two biennial courses of analytical and projective geometry at the University of Rome, whose regular teachers were Fabio Conforto and Enrico Bompiani. During the month of November 1939, Bompiani held both the chairs, because of Conforto's military task. Since 7 December 1939, Conforto obtained an extraordinary license of 30 days in order to carry on his university course. Considering the importance of this teaching, which was aimed at about 500 students, the Rector Pietro De Francisci asked later for an unlimited license for the rest of the academic year.[35] Conforto's teaching activity both at the

[33] The judging board of the academic competition for the chair of analytical geometry in the University of Turin was composed of the professors Francesco Severi, Enrico Bompiani, Giuseppe Marletta, Nicolò Spampinato, and Renato Calapso. The works of the commission took place at the University of Rome between the end of October and the beginning of November 1939. There were 12 candidates: Maria Ales, Giorgio Aprile, Achille Bassi, Pietro Buzano, Ugo Cassina, Fabio Conforto, Antonino Lo Voi, Ugo Morin, Margherita Piazzolla Beloch, Luigi Tocchi, Tullio Turri, and Mario Villa. The grade triplet was composed of Fabio Conforto, Mario Villa, and Margherita Piazzolla Beloch.

[34] *La produzione del Conforto rivela in lui un ricercatore originale, dotato di larghe vedute e di mezzi adeguati a tradurle in atto. Le questioni che si pone hanno sempre un effettivo interesse e sono sempre nettamente condotte a termine. [...] A ciò si aggiunga la profonda dimestichezza del Conforto con i rami più recenti e più elevati della geometria algebrica creati dal Severi; e l'agilità con cui il Conforto sa passare da questioni di geometria ad altre, di fisica matematica e di analisi, portandovi un prezioso corredo di conoscenze che in ogni caso gli consentono di raggiungere lo scopo propostosi. Le ottime attitudini didattiche del Conforto sono note*. See [70, p. 1684].

[35] Some documents, preserved at the Archive of the University of Rome, provide useful information about Conforto's calls to arms and academic licenses. The letters sent by the Rector of the University Pietro De Francisci to the War Minister (5 December 1939) and the Director of Mathematical School Enrico Bompiani to the Personnel Office of the University of Rome (7 December 1939) highlighted the importance of Conforto's teaching activity. *All'inizio delle lezioni,*

University and at INdAM was very relevant and appreciated. That's why he was often asked for military leave.

Despite military commitments, in November 1942, Conforto attended the Mathematical Congress of Rome, which took place between 8 and 12 November, when the fighting of WWII was at its most intense. The Congress was promoted by INdAM, organized and chaired by Severi, who held the opening lecture about contemporary mathematics and mathematicians (*Matematica e matematici d'oggi*). Although described as an international congress, only a few specially invited foreigners attended the Congress. Among the 137 participating mathematicians, there were 17 foreigners, who came from "not enemy" nations.[36]

One month later (on 1 December 1942), Conforto was appointed full professor in the chair of analytical geometry (with elements of projective and descriptive geometry) at the University of Rome.[37]

Military tasks slowed down Conforto's scientific activity. During the years 1942–1943, he wrote a joint paper together with Annibale Comessatti (1886–1945).[38] Because of WWII, Conforto was unable to fully practice his university

il 6 novembre 1939-XVIII, il Prof. Bompiani si assunse il gravoso incarico di iniziare anche il corso del Prof. Conforto; a partire dal 7 dicembre [1939] il corso fu continuato dal Prof. Conforto stesso, il quale ottenne una licenza straordinaria di giorni 30, con scadenza 6 gennaio 1940-XVIII. Quando le lezioni ricominceranno, dopo le vacanze natalizie, questa R, Università sarà costretta a sospendere il corso di Geometria Analitica del Prof. Conforto, se non potrà disporre del detto insegnante. Invero non può pensarsi di affidare continuativamente il corso del Prof. Conforto al Prof. Bompiani, il quale trovasi già gravato da molti altri insegnamenti. [. . .] Bisogna infatti tener presente che l'insegnamento è rivolto contemporaneamente a circa 500 allievi ingegneri e che si tratta di uno dei corsi di importanza capitale per la preparazione scientifica dei futuri ingegneri. Letter of the Rector De Francisci to the War Minister (2 December 1940). See Archivio Storico Università La Sapienza, *Fascicolo personale di Fabio Conforto*.

[36] The invited foreign mathematicians came from Germany (Wilhelm Blaschke, Constantin Caratheodory, Helmut Hasse), Bulgaria (Nicola Obreshkoff, Kiril Popoff, Ljubomir Chakaloff), Romania (Gheorghe Galbura, Miron Nicolescu, Gheorghe Vranceanu, Grigore Constantin Moisil), Norway (Poul Heegaard), Sweden (Torsten Carleman), Croatia (Rudolf Cesarec), Switzerland (Rudolf Fueter, Andreas Speiser), and Hungary (Bela Kerekjarto). The list of all the participants together with the lectures of the speakers were published in the proceedings of the Congress: *Atti del Convegno matematico tenuto in Roma dall'8 al 12 novembre 1942* [2]. Conforto gave a talk about the theory of the systems of equivalence and of the correspondences between algebraic varieties. See [26].

[37] *Con Decreto in corso di registrazione, il professore Fabio Conforto è nominato ordinario della Cattedra di Geometria analitica con elementi di proiettiva e geometria descrittiva con disegno di codesta Regia Università a decorrere dal 1 dicembre 1942 XXI.* See Archivio Storico Università La Sapienza, *Fascicolo personale di Fabio Conforto*.

[38] Conforto and Comessatti [51]. Comessatti graduated at Padua in 1908 under the guidance of Severi. In 1920, he was appointed professor of algebraic analysis and analytical geometry at the University of Cagliari. In 1922, he moved to Padua, where he stayed until his death in 1945.

tasks because he had to alternate between military service and the studies aimed at military applications at INAC. During the first part of 1943, Conforto again worked at the University of Rome, at INdAM, and at INAC. In this period, Picone's Institute was undertaking military applications as part of the war effort. In July 1943, Conforto went to Germany together with Picone. The journey was aimed to develop scientific relationship with German mathematicians.[39] Conforto and Picone visited some important German universities: Jena, Berlin, Hamburg, Heidelberg, Darmstadt, and Braunschweig. They were in touch with the main mathematicians of those universities.[40] Picone hoped for collaboration between INAC and the German institute of Braunschweig.[41]

4.1 Difficult Years: Rome, Reggio Calabria, Lecce

Meanwhile in Italy the political situation was quickly changing. On 9 July 1943, Allied forces invaded Sicily. The Allied landing on mainland Italy took place on 3 September 1943 in Reggio Calabria and on 9 September in Salerno on the western coast. As regards the Roman situation, on 19 July 1943, Rome had been bombed by Allied planes, causing many damages also to University structures. On 25 July, Mussolini was deposed. On 8 August, Conforto decided to volunteer for military service. He was firstly assigned to the Artillery Regiment in Foligno, and then, on

[39] Since some years, Picone hoped for a collaboration with the German armed forces. His main interlocutors were his pupil, Wolfgang Gröbner (1899–1980), and the German mathematician Gustav Doetsch (1892–1977). But still in 1942, Picone's project wasn't realized. Soon after the Mathematical Congress of Rome, Picone was invited for some conferences in Germany. Picone, who didn't speak German, asked Conforto for coming with him. See [67, pp. 132-133].

[40] From 1934 to 1943, Friedrich Karl Schmidt (1901–1977) and Robert König (1885–1979) represented pure mathematics in Jena. Helmut Hasse (1898–1979) was professor in Göttingen. From 1939 until 1945, Hasse was on war leave from Göttingen. He was an officer in the German Navy and he worked in Berlin on problems in ballistics. At the beginning of WWII, Hermann Schmid (1908–1986), pupil of Hasse, undertook a short spell of military service before moving to the University of Berlin in 1940 as an assistant to Harald Geppert. Wilhelm Blaschke (1885–1962) was professor at the University of Hamburg since 1919. He had a leading role in German mathematics until the end of WWII. In 1942, Blaschke made a lecture tour of Italy, and in November, he attended the Mathematical Congress in Rome. Hans Zassenhaus (1912–1991) was professor at Hamburg. After 1940, because of his refuse to join the Nazi Party, he resigned and joined the navy, working on weather forecasting during the remainder of WWII. Alwin Walther (1898–1967) was full professor at Technical University of Darmstadt since 1927 and director of the Institute for Applied Mathematics, which he built. Walther paid great attention to the practical application of mathematics, especially for the engineers. Wilhelm Schlink (1875–1968) was appointed assistant of mechanics at Darmstadt Technical University in 1900 and habilitated there for mechanics in 1903. In 1907, he was appointed associate professor and in 1908 full professor at Braunschweig Technical University. In 1921, he accepted a call to Darmstadt Technical University and worked there until 1949 when he retired.

[41] During WWII, Braunschweig was home to the Aeronautical Research Institute (Luftfahrtforschungsanstalt, LFA), a secret facility for airframe, aeroengine, and aircraft weapon testing.

16 August, he was moved to Reggio Calabria, where he joined the Italian Army. After the Allied landing in Reggio Calabria (3 September 1943), Conforto was taken prisoner. Because of war events, for 10 months, he had no contact with his family in Rome.

After the Armistice (signed on 8 September 1943), Conforto was released and sent to Lecce, where he worked for the Minister of War and at the Military Academy.[42] Conforto taught descriptive geometry and rational mechanics. During this period, he also collected and published the lectures he gave at the Military Academy.[43] On 4 June 1944, Rome fell to the Allies and Conforto could contact his family. In August, he was able to return to Rome and be reunited with his family. On 20 December 1944, the period of military leave ended. Conforto came back to his civil life, and he could resume his research and teaching activity on an ongoing basis.[44] During the years 1946 and 1947, he was also particularly active on the editorial side, publishing many textbooks for university and secondary school, often in collaboration with academic colleagues.[45]

In 1948, Conforto oriented his research interest toward quasi-abelian functions, soon after the publication of the work by Severi (*Funzioni quasi abeliane* [75]). Conforto's idea was to create for the quasi-abelian case a theory that was similar to that of Riemann matrices for the abelian functions. The paper *Sopra le trasformazioni in sé della varietà di Jacobi* ... contained the first construction of an arithmetical theory of the quasi-abelian functions.[46]

5 Conforto's Scientific Journeys

The years following the end of WWII were particularly important for Conforto's international achievement. He took part in many congresses, and he was invited to lecture both in Italy and abroad. In the summer of 1947, Conforto was sent by CNR to the International Congress on Engineering Education in Darmstadt as Italian delegate. In the section "Mathematics and Physics," presented by Prof.

[42] The Military Academy of Modena resumed its function in May 1944 at the barracks of Pico in Lecce as a Special Commando Royal Military Academy. After the end of the war and the fall of the monarchy, the Military Academy came back in Modena (1947).

[43] The handbook *Nozioni di geometria analitica, proiettiva e descrittiva ad uso degli allievi dell'Accademia militare di Lecce* was written jointly with Emilio Tomassi. See [55].

[44] During the period of WWII, thanks to some leave periods, besides the chair of analytical and descriptive geometry, Conforto kept the chair of number theory in the a.a. 1940–1941. He resumed the teaching of number theory in the a.a. 1944–1945.

[45] The handbooks [27–30, 64], and [31] were prepared for university students. Together with Giuseppe Vaccaro (1917–2004), Conforto wrote some textbooks for secondary school: [56, 57], and [58].

[46] See [32]. A second work dealt with univocal correspondences between points of a Picard quasi-abelian variety: [33]. Other works about the quasi-abelian functions were [37, 38], and [41]. Conforto also gave a talk about the theory of quasi-abelian functions and varieties at the Third Congress of UMI (Pisa, 23–26 September 1948).

Alwin Walther, Conforto gave a talk about the latest contributions gained at INAC, thanks to the researches made by Picone and his pupils, in the field of integration of partial differential equations. Conforto underlined that these new methods required powerful calculating machines for their numerical development. These kinds of machines, recently built in America, were still lacking in Italy.

1950 was probably the year of Conforto's consecration on an international level. Between January and February, he was invited by many European universities to give a series of conferences about algebraic geometry.[47]

At the end of summer 1950, Conforto took part to the International Congress of Mathematicians at Cambridge (Massachusetts, USA). Conforto travelled to the USA together with Beniamino Segre (1903–1977). After the Congress, the two mathematicians spent almost a semester as invited professors at the Institute for Advanced Studies of Princeton (October–November 1950). In a letter of introduction, prepared for Conforto in order to go to the USA, Guido Castelnuovo hoped for collaboration between Conforto and American mathematicians.[48]

> Dr. Fabio Conforto was for a period of many years my Assistant at the University of Rome. He is now full Professor at that University where he teaches the same Course I used to teach before my retirement from the University. He is an excellent teacher, a mathematician with a very large cultural background, an author of very good works in analytical geometry, in analysis (theory of Abel's functions) and in applied mathematics. He has taught very well many courses in the different branches of high mathematics. He is a person which I highly recommend, and I firmly believe that if he could sojourn for some time in an American Institution of high learning, it would be of a very great advantage for establishing more strict

[47] At the University of Basel, Conforto gave a conference about "New researches on the theory of abelian functions." Then he moved to Holland where he spent 2 weeks. At Gröningen University, he held two conferences. The first one dealt with historical item ("Historical evolution of mathematics in Italy"), and the second one was about algebraic geometry of surfaces and still open problems. As regards algebraic geometry, Conforto also presented three short talks on "Spirit and typical methods of Italian algebraic geometry." By invitation of the Mathematisch Centrum in Amsterdam, Conforto gave two conferences: "Some new methods for integration of linear partial differential equation used at INAC" and "Recent researches of algebraic geometry in the field of abelian and quasi-abelian functions." At Leiden University, he presented a historical conference about "Historical evolution and significance of projective geometry," while at Utrecht University, he talked about "The role of continuity in projective and algebraic geometry." In West Germany, Conforto was invited by the universities of Hamburg and Münster to hold conferences on "Irregular surfaces and abelian functions" and on "New researches on the theory of abelian functions." See Boll. Un. Mat. Ital. **(3)**, 5 (1950), n. 1, p. 98.

[48] At Princeton, Conforto worked closely with Carl Ludwig Siegel, who had arrived at the Institute for Advanced Study in 1940. Siegel was appointed to a permanent professorship at Princeton in 1946. In his lectures on functions of several complex variables at Princeton, Siegel developed the theory of abelian functions along the lines laid down by Conforto. Siegel's lectures were published in 1949: [76]. In 1966, Siegel prepared a revised version of his lectures. Through the works of Conforto and Siegel, Frobenius' theory of Jacobian functions had become a basic element in the classical treatment of abelian functions and varieties.

> relations between the work of the Italian and the American mathematicians, and moreover it would be of a great advantage for the progress of our Science.[49]

During the years 1951 and 1952, Conforto travelled extensively in Europe. He took part to international congresses and gave lectures by invitation of some European scientific societies in Austria, Switzerland, Germany, and Belgium.[50] This was a successful period. Conforto was internationally appreciated.[51]

However, back in Italy, Conforto became seriously ill in February 1953. He gave some lectures at INdAM on abelian modular functions. In autumn 1953, his health conditions were getting worse. Even when he was taken to a clinic, he still had his books with him as he struggled to work until the end. Conforto died in Rome on 24 February 1954.[52]

Following Conforto's death, some works based on his lecture notes were published by his colleagues and students. In 1956, the Austrian mathematician Wolfgang Gröbner published a revised version of Conforto's lectures about abelian functions. The volume "Abelian functions and algebraic geometry" [49] was based on lecture notes for courses given between 1940 and 1951. The lecture notes were collected by Conforto's pupils Mario Rosati and Aldo Andreotti.[53]

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[49] Letter of Guido Castelnuovo, President of the National Lincean Academy. Rome, 20 January 1950.

[50] In March 1951, Conforto and Picone took part to the Congress of the Society for Applied Mathematics and Mechanics (Freiburg im Breisgau). Conforto gave a talk in German about some results of experiments for periodical analysis that were carried out in the INAC. Then Conforto moved to Vienna where he was invited by the Austrian Mathematical Society for two conferences about the relationship between algebraic geometry and abelian functions. At the Swiss Mathematical Society (Neuchâtel, May 1952), Conforto gave a talk about algebraic manifolds that allow birational transformations in themselves (*Uber algebraische Mannigfaltigkeiten, die birationale Transformationen in sich gestatten*). In June 1952, Conforto, together with Aldo Andreotti, Oscar Chisini, and Mario Villa, took part to a conference of algebraic geometry, Belgium Center of Mathematical Research (Liège). Conforto's talk (*Problèmes résolus et non résolus de la théorie des fonctions abéliennes dans ses rapports avec la géométrie algébrique*) was published in the proceedings of the conference [46]. Then Conforto moved to Germany. He was invited by the universities of Hamburg and Berlin for some conferences. In September 1952, Conforto took part to the Third Mathematical Congress of the Austrian Mathematical Society in Salzburg giving a talk on abelian varieties. See Boll. Un. Mat. Ital. **(3)**, 7 (1952), n. 2, pp. 230–232; Boll. Un. Mat. Ital. **(3)**, 7 (1952), n. 3, pp. 357–361.

[51] The University of Hamburg would have liked to appoint him as the successor of Wilhelm Blaschke. See [6, pp. 212, 216].

[52] See [6, pp. 206-207].

[53] Aldo Andreotti (1924–1980) graduated in Mathematics in 1947 at the University of Pisa. He spent the next 3 years in Rome, first as "research student" at INdAM and then as assistant in the chair of geometry, where he could collaborate with Severi. In 1951, he was a visiting scholar at the Institute for Advanced Study at Princeton. In the same year, he won a chair of geometry at the University of Turin, and then in 1956, he moved to the University of Pisa. During the next 20 years, Andreotti often travelled abroad, and he worked and taught both in Pisa and in other foreign universities.

Introduzione alla topologia [50] consisted of the lectures Conforto had given at the University of Rome in the 5 years before his death. The lectures were collected by Mario Benedicty, another student of Conforto.[54]

6 Conclusions

In just over 20 years of scientific activity and despite the prolonged stops due to military service, WWII, and imprisonment, Fabio Conforto published a hundred works about algebraic geometry, algebra, analysis, theoretical and applied mathematics, and history of mathematics. These works were evidence of his extraordinary versatility.

Finally, we cannot fail to mention Conforto's commitment as an editor. Since 1939, he was member of the editorial board of the journal *Rendiconti del Seminario Matematico della R. Università di Roma* (now *Rendiconti di matematica e delle sue applicazioni*).[55] Soon after the end of WWII, Conforto took part in the editorial project of the *Enciclopedia Italiana*. He collaborated with Mario Niccoli (1904–1964), preparing both mathematical and biographical entries. Besides it, Conforto wrote an encyclopedic article for the *Enciclopedia delle Matematiche Elementari*, together with Severi, and an article about the postulates of Euclidean and non-Euclidean geometry in the *Repertorio di matematiche*.[56]

The vastness of Conforto's scientific interests is evidenced not only by many reviews, published in national and international journals, like *Bollettino dell'Unione Matematica Italiana*, *Zentralblatt für Mathematik und ihre Grenzgebiete*, and *Mathematical Reviews*, but also by various historical and educational papers. As regards Conforto's contributions about the history of mathematics, he wrote three collective articles on Italian scientific research and the development of algebraic geometry in Italy.[57] He devoted two papers to Bonaventura Cavalieri and Evangelista Torricelli, their life and scientific works.[58] The centenary of the publication of Riemann's thesis occasioned the publication of a short note.[59]

[54] Mario Benedicty (1923–2011), born in Trieste, received his PhD in mathematics from the University of Rome in 1946 and taught mathematics at Pontifical Gregorian University in the Vatican, La Sapienza University of Rome, and the University of British Columbia before going to Pittsburgh in 1958. Benedicty also collected some unpublished notes by Conforto: [4].

[55] The journal was founded in 1913 and started its publication in 1914 under the direction of Vito Volterra. Since 1939, the name of Conforto appeared in the editorial board of the *Rendiconti*. Editors in chief were Enrico Bompiani and Francesco Severi.

[56] See [53] and [45].

[57] Conforto [22], Conforto and Sobrero [54] and Conforto and Zappa [60].

[58] Conforto [34]. The Torricelliana Society of Science and Literature of Faenza was founded in 1948, and Conforto was elected corresponding fellow of the society. During the first congress of the society, on 25 October 1948, Conforto gave a commemorative lecture about Torricelli's life. See [35].

[59] Conforto [44].

Conforto was also interested in issues related to the teaching of mathematics, as confirmed by some articles published in the journal *Archimede*, addressed to teachers and connaisseurs of pure and applied mathematics.[60]

After having recalled Conforto's scientific work, it's evident that

> he never left the idea of a unified vision of mathematical sciences. As far as possible he aimed at connecting the most varied theories, as witnessed by his works.[61]

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[60] In [39], Conforto gave a historical report about projective geometry, while the paper [40] was devoted to algebra and the theory of equations. Another work dealt with some notes about real numbers: [47]. Other educational works written by Conforto are[36, 42], and [48].

[61] *Dopo taluni lavori giovanili nel campo della teoria delle funzioni, la sua attività si è volta principalmente alla geometria algebrica, senza però abbandonare mai una visione unitaria delle scienze matematiche, come provano i suoi lavori, numerosi anche in campi più o meno lontani da quello originario, ma sempre intesi a collegare, per quanto possibile le più svariate teorie*. See [3, p. 227].

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