Available online at www.sciencedirect.com

SciVerse ScienceDirect

Historia Mathematica 39 (2012) 432–459

HISTORIA MATHEMATICA

www.elsevier.com/locate/yhmat

German mathematicians in exile in Turkey: Richard von Mises, William Prager, Hilda Geiringer, and their impact on Turkish mathematics

Alp Eden [a,1], Gürol Irzik [b,*]

[a] *Boğaziçi University, Department of Mathematics, 80815 Bebek-Istanbul, Turkey*
[b] *Sabancı University, Faculty of Arts and Social Sciences, Orta Mahalle, Üniversite Caddesi No.: 27 34956 Tuzla-Istanbul, Turkey*

Abstract

There is a sizable and growing literature on scholars who fled from the Nazi regime, a literature which often focuses on the periods before leaving Germany and after settling permanently in the USA, but relatively less work on the interim period in which many of them found temporary homes in countries such as Turkey. In this article we would like to discuss the scholarly work, activities and the impact of mathematicians Richard von Mises, William Prager and Hilda Geiringer during their stay in Turkey. We argue that the establishment and the development of applied mathematics and mechanics in Turkey owe much to them.

Zusammenfassung

Es gibt eine betrachtliche und wachsende Forschungsliteratur zu den Gelehrten, die aus dem NS-Regime flüchteten; diese Literatur befaßt sich oft mit den Zeiträumen vor dem Verlassen Deutschlands oder nach dem dauerhaften Niederlassen in den Vereinigten Staaten. Es gibt aber verhältnismäßig wenig Arbeit über die Übergangszeit, in der viele von ihnen vorübergehendes Heimat in Ländern wie der Türkei gefunden haben. In diesem Aufsatz möchten wir die wissenschaftliche Arbeit, Aktivitäten und Auswirkungen der Mathematiker Richard von Mises, Wilhelm Prager und Hilda Geiringer während ihres Aufenthalts in der Türkei diskutieren. Wir argumentieren, daß die Errichtung und die Entwicklung der angewandten Mathematik und Mechanik in der Türkei ihnen viel verdanken.

MSC: 01A60; 01A70; 01A73

Keywords: Richard von Mises; William Prager; Hilda Geiringer; Istanbul Technical University; Applied mathematics; Mechanics

* Corresponding author. Fax: +90 216 4839250.
E-mail addresses: eden@boun.edu.tr (A. Eden), irzik@sabanciuniv.edu (G. Irzik).
1 Fax: +90 212 2877173.

0315-0860/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.hm.2012.07.002

1. Introduction

The year 1933 was a turning point in the history of higher education system and a fortiori of science in Turkey. Merely 10 years after the formation of the Turkish Republic, the system of higher education went through a radical transformation, as part of a series of revolutionary reforms carried out under the leadership of Mustafa Kemal Atatürk in the political, social, legal and cultural domains. The aim of these reforms that ranged from abolishing the caliphate to the adoption of Western legal codes and the Latin alphabet, was to modernize the Turkish society, and education was seen as a key element for the success of modernization. As a result, Darülfünun—the only existing university in the country at the time—was closed down on the 31st of July in 1933, and Istanbul University was founded literally the next day. The academic reasons behind this were detailed in the Malche report written upon the invitation of the Turkish government by Albert Malche, a professor of pedagogy at the University of Geneva. According to the report, Darülfünun was an outdated teaching institution that produced no original research and publication and that its enormous autonomy turned it into a closed institution that had lost touch with the rest of the society [Widmann, 1999, 75–76]. Thus, in the eyes of the reformers it was necessary to turn it into a modern higher institution of learning and research. However, these were not the only reasons for abolishing Darülfünun; there was also a political motivation behind it. Reşit Galip, who was the mastermind of the reform and the minister of education at the time, publicly accused Darülfünun professors of not embracing the massive reforms of the young Republic enthusiastically [Bilsel, 1943, 34–35]. It is therefore small wonder that the founding of Istanbul University meant at the same time a liquidation of the existing faculty at Darülfünun: 157 out of 240 faculty members were dismissed from their positions, and 71 of those were full professors [Bilsel, 1943, 37].

The very year Istanbul University was founded, Hitler came to power in Germany, and a forced exodus of thousands of German academics began. While most of them went to the USA, a good many of them came to Turkey. In May of 1933, Malche informed Philipp Schwartz, who was the informal leader of a group of German scholars in exile in Zurich, of the plans of the Turkish government. Schwartz went to Turkey and carried out the negotiations with Turkish officials, which resulted in the hiring of 30 full professors in July of the same year.[2] According to the most reliable sources, 52 full professors, 50 of whom were German and 2 of them were Austrian, taught at Istanbul University as emigrants between 1933 and 1945. Of these 52 professors, 16 taught at the Faculty of Medicine, 15 at the Faculty of Sciences, 14 at the Faculty of Letters, and 7 at the Faculty of Law; in addition, there were about 80 assistants, technicians, lab technicians and nurses (extracted from [Dölen 2010, vol. 3, 500–506; Widmann, 1999]. Several other German and a number of British, French, Hungarian and Swiss professors came to teach at Istanbul University but not as emigrants. Thus, Istanbul University was truly a cosmopolitan institution during the 30s and the early 40s.

The most famous of the German scholars were mathematicians Richard von Mises and William Prager, astronomer Erwin Finley Freundlich, physicist Arthur von Hippel, economist Fritz Neumark, philosopher of science Hans Reichenbach, romanists Leo Spitzer and

[2] The breathtaking story of this episode of history is well-known. See [Schwartz, 2003; Widmann, 1999].

Eric Auerbach, and arabist Helmut Ritter.[3] A vast majority of the German professors were appointed as institute heads with full authority. They changed the curricula, the practice of teaching and research, influenced their Turkish colleagues greatly and played an important role in hiring, promotions and awarding doctoral degrees. Thus, it is not an exaggeration to say that they shaped the future of science and humanities and social sciences for years to come at Istanbul University and indeed in Turkey either directly or indirectly through their colleagues and students.

There is a sizable and growing literature on scholars who fled from the Nazi regime, a literature which often focuses on the periods before leaving Germany and after settling permanently in the USA, but relatively less work on the interim period in which many of them found temporary homes in countries such as Turkey. In this article, we would like to discuss the scholarly work, activities and the impact of mathematicians Richard von Mises, William Prager and Hilda Geiringer during their stay in Turkey. Our research is based on archival material and Turkish as well as non-Turkish sources. Among the Turkish sources we would like to mention especially Emre Dölen's magisterial five-volume history of the Turkish university system from 1863 to 1981 [Dölen, 2009, 2010], Sevtap İshakoğlu-Kadıoğlu's history of the Faculty of Sciences of Istanbul University 1900 through 1946 [İshakoğlu-Kadıoğlu, 1998], Orhan İçen's review of the publications and other contributions of the mathematics faculty members of Istanbul University [İçen, 1982], Erdal İnönü's bibliography of mathematical research covering the period 1923–66 [İnönü, 1973], and an edited volume on the historical development of the conception of university in Turkey [Aras et al., 2007].

We argue that the trio of von Mises, Prager, and Geiringer considerably influenced the development of mathematics in Turkey, particularly in the direction of applications. Indeed, just as the birth and the establishment of the discipline of applied mathematics in the USA from the late 1930s onward owed a great deal to German scientists such as Richard Courant, John von Neumann, Theodor von Karman, Richard von Mises and William Prager, we will argue that the establishment and the development of applied mathematics and mechanics in Turkey also owed much to the trio of German mathematicians Richard von Mises, Willy Prager and Hilda Geiringer.

2. The founding of the Institute of Mathematics in Istanbul University

Teaching of various branches of mathematics has a long tradition in the history of Darülfünun, going back to the last quarter of the 19th century. Mathematics courses taught included differential and integral calculus, mechanics, geometry, analysis and probability theory. During the 1932–33 academic year, which was the last year of Darülfünun, Şükrü Bey, Ali Yar Bey, Salim Bey, Hüsnü Hamid Bey and Kerim Erim were the main mathematicians. After the 1933 university reform, only Ali Yar and Kerim Erim were kept employed, the others were dismissed from Istanbul University [İshakoğlu-Kadıoğlu, 1998, 53–64].

With the 1933 reform, the Institute of Mathematics was modeled upon the recommendations of the mathematician Richard Courant, the future founder of the Courant Institute in New York. Courant, together with the Nobel laureate physicist James Franck and Max Born (who was to receive the Nobel prize in 1954), visited Turkey shortly before the

[3] For a full list, see [Widmann, 1999].

university reform and wrote a report to the Turkish Minister of Education.[4] In that report Courant emphasized the important role mathematics plays in training qualified teachers and engineers and suggested that the Institute be organized like the one at "the University of Göttingen which is due to Felix Klein and now exemplary for the whole world. Of course the organization has to be adapted to the possibilities and necessities of the local conditions. Important targets: High and stern scientific standards, maintaining relations with applied sciences, consideration of pedagogical principles during instruction, close contact between students and teachers". The reference to Göttingen, Klein and applied sciences leaves no doubt that Courant envisioned essentially *an institute of applied mathematics* at Istanbul University.[5] Courant recommended that there should be at least three full chairs in the Institute and thus a number of senior faculty and assistants. He specifically pointed out that the senior faculty to be hired should be adaptive and young, say, between the ages of 30 and 45, as it was often the case in Germany. In his context he praised the Turkish mathematician Kerim Erim and considered him to be "the nucleus" for restructuring. He wrote: "As far as staff is concerned, the university is lucky enough to have an excellent scholar—also by European standards—who combines devotedness to science, versatility and activity and who could just as well hold a high position at any German university." In addition, he suggested four names of Jewish mathematicians, the first three Germans, the fourth the son-in-law of the Göttingen mathematician Edmund Landau, in the following order: W. Prager, S. Cohn-Vossen, W. Fenchel and I. Schoenberg. He also emphasized the importance of establishing close ties with European scholars and advised that a renowned scholar be invited for a month or two every year to give seminars and lectures. Finally, he strongly urged the Turkish government to pay attention to the infrastructure from classrooms to the building of a library: In his own words: "Everything should be built from scratch".

Courant's recommendations for establishing essentially an institute of applied mathematics with close ties with other applied sciences resonated well with the intentions of the Turkish reformers who saw education as a means not only for producing qualified human power, but also for the material development of the country. Turkish government's top choice for the position of the director of the Institute of Mathematics was naturally Courant. Courant first discussed the whole matter with Schwartz face to face in Zurich and the next day sent him a long letter, expressing a reserved interest in the offer. The main point of the letter was that Courant still considered himself to be a Prussian civil servant and thus insisted that the Turkish government should carry out the negotiations about the hiring of scholars with the consent of the German authorities. He wrote: "Circumstances might force me to go abroad, but it is most essential to me to do this not as an embittered emigrant, but as a proud representative of German culture who will not, either inwardly or outwardly, give up his connectedness to his home country."[6] Courant reiterated the same concern a week later, this time in a letter to the Greek mathematician Constantin Carathéodory whose father was a high-ranked Ottoman diplomat who lived in Istanbul for

[4] Preliminary Report, 15 August 1933, Folder 740, box 93, RG2. Rockefeller Foundation Archives, RAC. Courtesy of RAC. The report not only convinced the Turkish government that the reform would succeed, but also played a positive role in the final decisions of the exiled German scientists to go to Turkey [Schwartz, 2003, 51].

[5] For the emergence of the new field of applied mathematics at Göttingen under the leadership of Klein, see [Siegmund-Schultze, 2009a, 278–279] and the literature cited therein.

[6] Letter from Courant to Schwartz, dated 12 July 1933, MC 150, Richard Courant Papers, courtesy of New York University Archives.

a while.[7] In that letter he also inquired about the living costs and conditions in Istanbul.[8] The next day he sent a letter to Prager about the plans of the Turkish government and wrote: "The whole matter seems to be a serious one and might turn out to be quite an attractive occasion. The financial conditions will surely not be great, but will probably do".[9] Shortly after, Courant, Born, and Franck took a trip to Turkey and met the Turkish officials. Courant wrote his report to the Turkish government discussed above after this visit. He also sent a letter to Dr. Lauder Jones of the Rockefeller Foundation in Paris, expressing serious doubts about bringing Istanbul University to the level of a European one in a few years due to the poor material and academic conditions, especially in physics and mathematics.[10] As a result, he turned down the Turkish government's offer (see also [Siegmund-Schultze, 2009a, 141–142] and compare [Reid, 1996, 154]).

Turkish officials were insistent on having someone who was world famous and so turned to Richard von Mises, who accepted the offer and taught from 1933 to 1939. At the time von Mises was 50 years old, and before coming to Turkey, he had been the director of the Institute of Applied Mathematics at the University of Berlin and had published extensively in applied mathematics, aerodynamics, plasticity theory, probability theory and mathematical statistics. Especially worth noting are his work in the theory of plasticity for formulating what was later called the "von Mises yield condition" [Mises, 1913] and in the foundations of probability, where he developed a notion of randomness and the frequency interpretation of probability [Mises, 1919]. He was also the founder of the journal *Zeitschrift für Angewandte Mathematik und Mechanik* in1921.[11] von Mises brought Hilda Geiringer to Turkey as his assistant in 1934 and later married her in 1943.[12] Geiringer had obtained her Ph.D. in Mathematics from the University of Vienna in 1917. Although trained as a pure mathematician, she became von Mises' assistant at the University of Berlin and came under his influence, as a result of which she received her "Habilitation" in applied mathematics with a thesis that combined statistics and mechanics.[13] She taught at Istanbul University between 1934 and 1939.

Following Courant's recommendations, Turkish officials also appointed William Prager and Kerim Erim as full professors. Prager was then a 30 year old, brilliant rising

[7] For an excellent biographical work on Carathéodory, see [Georgiadou, 2004].
[8] Letter from Courant to Caratheodory, dated 19 July 1933, MC 150, Richard Courant Papers, courtesy of New York University Archives.
[9] Letter from Courant to Prager, dated 20 July 1933, MC 150, Richard Courant Papers, courtesy of New York University Archives.
[10] Letter from Courant to Jones, 5 September 1933, Folder 740, box 93, RG2, Rockefeller Foundation Archives, RAC. Courtesy of RAC.
[11] For a succinct discussion of von Mises' scientific achievements, see [Siegmund-Schultze, 2009b]. Siegmund-Schultze [2004], which contains a valuable biographical sketch of von Mises by Geiringer, provides the outlines of a scientific biography of von Mises. An excellent source for von Mises' scientific papers is [Mises, 1963–64].
[12] It is perhaps worth noting that a simple inspection of the lists provided by Taşdemirci [1992, 112–116], Dölen [2010, vol. 3, 503–504] and İshakoğlu-Kadıoğlu [1998, 34–38] reveals that of the nine assistants brought by the emigré scientists who taught at the Faculty of Sciences in 1934, only Geiringer was female. This situation did not change when the number of assistants increased to 18 by 1937. By contrast, of the 38 Turkish assistants who belonged to the Faculty of Sciences, 18 of them were female.
[13] For a biographical sketch of Geiringer and the controversy surrounding her "Habilitation", see [Siegmund-Schultze, 1993].

star who had already published over 30 articles in various areas of applied mathematics, especially in mechanics, elasticity and plasticity theory. He obtained his doctorate in engineering from the Technical University of Darmstadt in 1926 and then moved to the University of Göttingen.[14] He taught at Istanbul University between 1933 and 1941. Kerim Erim, aged 39 at the time, was also an excellent mathematician, who, after attending both Berlin and Erlangen Universities, had received his Ph.D. degree in mathematics with a thesis entitled "Über die Trägheitsformen eines Modulsystems" in 1929.[15] According to some sources, he was the first Turkish mathematician to have received a doctoral degree in mathematics [İnönü, 1973, 26]. Upon returning to Turkey, he began teaching differential and integral calculus, analytical geometry and mechanics in the College of Engineering[16] and then was appointed as a member of the committee in charge of the 1933 university reform. When Istanbul University was founded in 1933, he became the first dean of the Faculty of Sciences for a brief period [Dölen, 2010, vol. 3, 241–242]. In addition to courses in mathematics, he also taught relativity theory and was one of the first to introduce the theory to the Ottoman/Turkish readers [Akbaş, 2003]. Erim was a very cultured person who had wide interests in literature and philosophy, especially in the philosophy of mathematics and physics, and attended Hans Reichenbach's lectures at Istanbul University [Bahadır, 2006]. He was an amiable person who had excellent administrative skills. Indeed, just as Courant had envisioned, he masterfully orchestrated the relations among German and Turkish mathematicians and the university officials, in effect co-directing the Institute of Mathematics with von Mises [Arf, 1973]. There is also evidence that Erim knew about at least some of von Mises' work before the two became close colleagues at Istanbul University.[17] He published widely in mechanics, geometry, analysis and relativity theory in Turkish (see [Akbaş, 2003] for a list of his publications). He was also instrumental in attracting Cahit Arf, Ratip Berker and Ferruh Şemin as young and promising assistants. Below we will say more about them. In short, the flourishing of mathematics at Istanbul University after the 1933 reform owed much to Erim's efforts.

Turkish reformers followed Courant's recommendations in other respects as well. The Institute of Mathematics was made part of the Faculty of Sciences, which also included the institutes of astronomy, physics, chemistry, zoology, genetics and botany. It consisted of three sub-divisions (chairs, as they were called following the German academic tradition): general mathematics and algebra, integral and differential calculus and analysis,

[14] For a brief biographical sketch, see [O'Connor and Robertson, 2005].

[15] Erim's file at the University of Erlangen reveals that he wrote his dissertation under the supervision of Ernst Fischer and passed the doctoral examination in 1919, but that he presented the final printed version a decade later, thus officially receiving his doctoral degree under Otto Haupt, the successor to Ernst Fischer, in 1929. We thank Reinhard Siegmund-Schultze for sharing this information with us.

[16] In Turkish, Yüksek Mühendislik Mektebi, an institution of higher education separate from Istanbul University.

[17] See [Erim, 1930, 1931]. The former introduces what is today known as the "von Mises formula", and the latter is a translation of [Mises, 1930]. von Mises, an aristocratic person who did not make friends easily, thought highly of Erim, as documented by his unpublished diaries [Siegmund-Schultze, unpub.].

and mathematical mechanics and geometry. The Faculty of Sciences was located in Zeynep Hanım Mansion, which was an old, three-floor building constructed in the late 19th century.[18]

3. Salaries, working conditions, and teaching

Non-Turkish faculty members were typically given five-year contracts and paid handsomely in comparison to their Turkish counterparts.[19] This was obviously thought necessary by the Turkish government in order to attract the best of them. According to Emre Dölen, some non-Turkish full professors were paid better than the president of the university and, on the average, "the salary of a foreign "ordinarius professor" [the equivalent of a full professor] was about two and a half times more than that of his Turkish equivalent" in the year 1936, and this is true of other faculty members and assistants as well, a situation which gave rise to complaints and tensions [Dölen, 2010, vol. 3, 493–495]. It appears that in the year 1934 the highest salary went to von Mises, the next highest salary was Hans Reichenbach's, and Prager's salary was about two-thirds of von Mises' [İshakoğlu-Kadıoğlu, 1998, 65]. This is a clear sign of how greatly the Turkish government valued the emigré professors and especially von Mises. Given the relatively low cost of living in Turkey, salaries of non-Turkish professors provided their earners a comfortable life.[20]

As for the teaching duties, von Mises and Prager taught courses in the sub-division of mathematical mechanics and geometry [İshakoğlu-Kadıoğlu, 1998, 65]. According to Geiringer, von Mises did not teach mechanics at all, but only "mathematics and probability" [Siegmund-Schultze, 2004, 365]. Hand-written notes taken by Yomtov Garti (the first Ph.D. student of von Mises, see Section 5.2) gives us a good idea of what von Mises taught in his mathematics courses. During the academic year 1933–34, von Mises gave a course in "Differential and Integral Calculus" that covered the standard material taught in such courses. During the academic year 1934–35, he gave a course in "Analysis" that covered ordinary and partial differential equations, complex analysis, calculus of variations, and potential theory.

[18] It was large enough to have an auditorium with a capacity of 1000, but not every institute (such as botany) had sufficient space for its needs (see the website of the current Biology Department at Istanbul University at http://www.Istanbul.edu.tr/fen/en/biy/botanik-bahcesi.php). Unfortunately, the mansion was burned in 1942, the fire destroying all the files and documents as well.

[19] Five-year contracts typically included the following clauses: all salary figures indicate net monthly incomes; professors could give their lectures in German, French and English during their first three years, after which they are expected to lecture in Turkish; their and their families' moving expenses (in both directions) are to be paid by the Turkish government. Copies of typical contracts from the year 1933 can be found in [Dölen, 2010, vol. 3, 605–611]. Furthermore, at least some contracts (such as Prager's) were such that increases in taxes did not affect the net salaries (see [İshakoğlu-Kadıoğlu, 1988, 287]. From this it follows that the same must be the case with other eminent professors like von Mises and Reichenbach.

[20] In a letter dated 1935, Hans Reichenbach made this point explicitly by comparing his salary at Istanbul University to the salary he would have received had he accepted the offer of the Oxford University [Irzik, 2011, 160–161]. Many Turkish faculty, on the other hand, often felt the need to teach at two institutions to make ends meet.

Teaching of mechanics was left to Prager, and indeed, Prager taught not only mechanics, but also tensor analysis, descriptive and projective geometry.[21] It is fair to say then that there was a clear division of labor between von Mises and Prager in terms of teaching: while Prager taught the required courses in mathematical mechanics and geometry, von Mises seems to have taught whatever he saw fit in mathematics and probability. As for Geiringer, she seems to have taught basic courses in mathematics, such as calculus, the lecture notes of which were published in Turkish (see below and Appendix B). By the academic year 1941–42, within a period of only 8 years since the 1933 reform, the number of faculty in the Institute of Mathematics increased to eleven even though the trio of Richard von Mises, Prager and Geiringer had left by then[22], and the number of courses offered totaled 28.[23]

During their first years, von Mises and Prager lectured mostly in German and French, and their lectures were consecutively translated by assistants. In this respect they were lucky since their translators were Cahit Arf, Ratip Berker and Ferruh Şemin [İshakoğlu-Kadıoğlu, 1998, 65–67]. Since non-Turkish readers may not be familiar with them, we would like to say a few words about each.

Cahit Arf (1910–97), arguably the most distinguished Turkish mathematician of the 20th century, studied mathematics as an undergraduate at the École Normale Supérieure in Paris and then became an assistant at Istanbul University in 1933. With a recommendation from von Mises he went to Göttingen in 1937 and received his Ph.D. degree under the supervision of Helmut Hasse in 1938. In his thesis Arf gave an arithmetic proof for Artin's conductor formula for normal algebraic number fields using a local class field theory in the spirit of Hasse's principle. He is well known for the Arf Invariant, Arf Rings, Arf closure, and the Arf-Hasse theorem. He then returned to Istanbul University and taught there until 1962. In 1953 he became the director of the Institute of Mathematics after Erim died.[24]

Ratip Berker (1909–97) studied mathematics at Nancy and Lille Universities in France and then became an assistant at Istanbul University in 1933. He then went back to France and received his Ph.D. degree under the supervision Marie-Joseph Kampé de Fériet at Lille University in 1936. In his dissertation Ratip Berker studied special analytic solutions of the incompressible Navier–Stokes equations, a love affair that culminated in his most cited work that appeared as a volume in the *Handbuch der Physik* [Berker, 1963]. After receiving his Ph.D., he became an instructor in the Institute of Mathematics. The committee for his appointment included both von Mises and Prager who praised his work.[25] He taught both in the Institute of Mathematics and in the College of Engineering, which became Istanbul

[21] Letter from Prager to Courant, dated 27 November 1937, MC 150, Richard Courant Papers. Courtesy of New York University Archives. In that letter Prager complains of not having sufficient stimulation, library resources and above all time for doing research since he is teaching 14 h per week. In that letter he also writes that preparing lectures in Turkish takes too much of his time.

[22] von Mises and Geiringer left in 1939 for Harvard University and Bryn Mawr respectively, and Prager left in 1941 for Brown University. Of the eleven, the only non-Turkish faculty member was Patrick du Val who taught at the Institute of Mathematics from 1941 to 1949. Patrick du Val was a first-rate British mathematician who specialized in algebraic geometry and had received his Ph.D. under the supervision of Henry Baker at Cambridge University in 1930. For a biography that includes his mathematical contributions and a list of his publications, see [Tyrell, 1989].

[23] For a complete list of these courses and the faculty members who taught them, see [İshakoğlu-Kadıoğlu, 1998, 68–69].

[24] For an excellent biography of Arf, see [Terzioğlu and Yılmaz, 2005]. Arf's picture appears on a ten-lira banknote today.

[25] See their report in [İshakoğlu-Kadıoğlu, 1998, 202–203].

Technical University in 1944, the second university founded in Turkey. A law passed in 1946 banned teaching at two separate institutions, so he chose to teach at Istanbul Technical University, resigning from his job at Istanbul University [İshakoğlu-Kadıoğlu, 1998, 204].[26]

Ferruh Şemin(1908–85) studied mathematics at Grenoble University and then became an assistant in the Institute of Mathematics at Istanbul University in 1933. He received his Ph.D. from the Institute of Mathematics at Istanbul University in 1944 [İshakoğlu-Kadıoğlu, 1998, 297–298]. He was one of the first mathematicians to receive a Ph.D. in the Institute of Mathematics. We will say more about him below.

Back to Prager, von Mises and Geiringer now. Prager learned and began lecturing in Turkish in 2 years as his first book, based on his lecture notes, published in Turkish in 1935 attests [Prager [17], Appendix A]. This is a remarkable achievement not simply because Turkish is very different from German (the former is a Uralic-Altaic language, the latter is Indo-European), but also because during the 30s a radical purification of the Turkish language was in effect as part of the campaign for the "new Turkish". New terms were being constantly invented from scratch, so to speak, and the change was bewildering, hard to keep track of even within a period of a couple of years. In this context it is instructive to compare the terminology of Prager's books in Turkish, published 6 years apart. von Mises and Geiringer, on the other hand, experienced some difficulty; it took them 4 years to lecture fully in Turkish [Siegmund-Schultze, 2009b, 142, no. 153 and personal communication]. Cahit Arf, one of the assistants at the time, had this to say about von Mises' and Prager's lectures:

> "Von Mises' and Prager's lectures were translated by Ratip Berker, Ferruh Şemin and myself. (...) We the young mathematicians did not learn much from these early professors. Among them was the great mathematician Richard von Mises. We could have learned from him but could not because both he and we had too much pride. We could not establish a rapport with him easily, and besides we were not interested in his areas of research. However, Kalutsyan, Consoli, Garti, and Kapuano learned much from him. Caricaturing, I can say that we attended von Mises' and Prager's lectures, translated them, but devoted our attention to the errors made and criticizing them.[27] The real benefit we got from these foreign professors was that they showed us by example that scientists should do research and be creative." [Arf, 1973, 38–42][28]

In this context we would also like to mention that a tradition of public lectures inaugurating the beginning of each academic year at Istanbul University, known as "University Conferences", was initiated from 1935 onward. These lectures were non-technical and aimed to give a general picture of the most recent developments in each academic field. They were open to the public, well attended and lasted about a week. While von Mises gave one lecture, Prager gave two lectures in this tradition. von Mises' talk, which opened the 1937–38 academic year, was a historical survey of mechanics from Newton to Schrödinger

[26] Two special issues of the *Bulletin of the Technical University Istanbul* (vol. 39, no. 3/4, 1986 and vol. 40, no. 1/2 1987) were dedicated to Berker on the occasion of his 75th birthday. See also [Altay and Dökmeci, 2000] for a brief biographical sketch.

[27] This is in line with the fact that von Mises committed "blunders" and "slips" even in his published works, something he himself acknowledged [Siegmund-Schultze, 2004, 347].

[28] We should note, however, that the "we" in this passage should be interpreted mainly as referring to Arf himself and Ratip Berker, but emphatically not to Ferruh Şemin. Şemin learned much from von Mises as his publications indicate. See Section 5 below.

[von Mises, 1939]. Prager too gave a talk during the same week and discussed the physical principles of airplanes [Prager [18], Appendix A]. The 1940–41 University Conferences were devoted, understandably, to the relationship between war and "science" (including not just natural and biological sciences, but also social sciences and humanities). Prager chose the same topic as before and gave a lecture on scientific problems regarding the construction of war planes [Prager [20], Appendix A).

4. Publications of von Mises, Prager, and Geiringer at Istanbul University

Despite their relative isolation and the underdeveloped state of mathematics in Turkey, all three emigrés were quite productive during their stay. von Mises' works and publications throughout his life (including those written during his Istanbul years) are well-documented and commented upon by Geiringer who devoted herself to editing them after von Mises' death [Siegmund-Schultze, 2004, 361–366]. According to Geiringer, von Mises produced 30 publications during his stay in Turkey: 17 of them on probability, six of them on mechanics, and some on practical analysis and geometry. Geiringer emphasized the fact that during this period von Mises' "interest in *generals* is very great" [Siegmund-Schultze, 2004, 365, emphasis original]. This is best reflected by his main philosophical work, namely, *Positivism* published originally in 1939, a book of 400 pages. Contrary to its title, this is not a book *on* positivism, strictly speaking, as von Mises himself notes in the preface [Mises, 1951, v]. Rather, it is a synthetic work of a positivistically minded scientist, who reflects on every significant aspect of intellectual life ranging from language to the foundations of formal, natural and social sciences, from metaphysics and ethics to art, literature, and religion, emphasizing the interconnectibility of all human knowledge. One is tempted to say that it is the kind of book that could only be written in relative isolation and that the exile in Istanbul seems to have provided the opportunity and the right circumstances.

Prager too was quite productive during his stay in Turkey between 1933 and 1941. He published 18 articles (only two of them in Turkish, based on his lectures in the "University Conferences" series) and three books in Turkish despite his heavy teaching load. We provide a list of them as Appendix A. Most of his articles were on plasticity theory, including a joint paper with Geiringer [Prager and Geiringer [1], Appendix A]. His work in Istanbul on this topic culminated in [Prager, 1942], which he wrote after moving to the US. In that paper Prager acknowledges the fact that he started developing this theory while in Istanbul and presented some of his results in the Fifth International Congress of Applied Mathematics that took place in Cambridge, Massachusetts in the USA in 1938. Indeed, he had already published two papers on the topic, both of which were written in Turkey (Prager, [14], [15], Appendix A). Much earlier, dating back to a publication in 1913, von Mises had contributed to the theory of plasticity with his own version of the yield theory, nowadays known as the "Mises' yield condition". As it is the case for all such phenomenological theories, its success depends on how well it approximates the real world, which includes materials ranging from soil and concrete to steel, and hence the need for testing the theory for different materials. Prager argued that the theory did not perform well between the plastic and the elastic state and developed a new theory that accounts for the transition from the elastic to the plastic state. The development of his theory dates back to his days at Istanbul University, but is not confined to those times. In fact, a recent survey in strength theories indicates the

plethora of yield theories in the 20th century while emphasizing Prager–Drucker's yield condition as a natural extension of von Mises' [Yu, 2002].[29]

As for Geiringer, she too published extensively, though determining the exact number of her papers published or written while she was in Turkey presents some difficulties.[30] Our educated guess is that she wrote or published at least 18 papers in English and a book in Turkish during her stay in Turkey[31]. The book in Turkish was an introduction to calculus for chemistry students based on her lecture notes compiled by Hermine Kalustyan, one of the first to receive a Ph.D. degree in the Institute of Mathematics [Geiringer [22], Appendix B]. Geiringer's papers were on the theory of plasticity, mathematical statistics, the theory of probability and the latter's applications to genetics. Indeed, she was a pioneer in applying probability theory to Mendelian genetics, a research program in which she became interested while she was in Turkey. This program involved the development of appropriate mathematical tools (basically, deriving a set of difference or recursive equations, the methods to solve them in some special cases and studying their asymptotic behavior) on the one hand and their applications to concrete or specific cases in genetics on the other hand. Geiringer's first paper which explores the mathematical basis of genetics was on Weinberg's *statistical experimental method*, published in the journal of the Faculty of Sciences of Istanbul University in 1936 [Geiringer [10], Appendix B][32]. Then followed three more papers published between 1939 and 1941. In one of them [Geiringer [18], Appendix B], she used probability theory to study the evolution of the distribution of blood types in two populations, a problem suggested to her by Ernest Caspari and Hugo Brown of the Faculty of Medicine.[33] The other one was jointly written with the geneticist Curt Kosswig, on the calculus of the transformation of the female heterogamety, published also in the journal of the

[29] We thank Cengiz Dökmeci for drawing our attention to this article.

[30] For example, given that she came to Turkey in 1934 [Binder, 1992], we are not sure whether her 1934 papers were written in Turkey or not. On the other hand, even though she left Turkey in 1939, the 1941 paper she co-authored with Kosswig (Geiringer and Kosswig, [21], Appendix B) was in fact written in Turkey.

[31] See Appendix B. Binder [1992] provides a complete list of her publications.

[32] We thank Reinhard Siegmund-Schultze for pointing this out to us. It is also worth noting that this paper takes its cue from [Mises, 1931].

[33] Ernest Caspari (1909–80) was a pioneer in developmental genetics who received his doctoral degree with his experimental work on the mechanism of gene action in the famous Kühn laboratory under the direction of Alfred Kühn at the University of Göttingen in 1933. He was appointed to the Institute of Biochemistry under professor Werner Lipschitz's directorship in the Faculty of Medicine at Istanbul University in 1935. Caspari left for the US in 1938, joining first Lafayette College and then Wesleyan and Rochester Universities as a professor of biology. He was elected President of the Genetics Society of America and also served as Editor of Genetics from 1968 to 1972. See [Grossbach, 2009] for an informative scientific biography. Hugo Braun (1881–1963) studied medicine in the German University in Prague. He specialized in microbiology and immunology and taught at the University of Frankfurt and University of Heidelberg respectively. He received the Paul Ehrlich prize for his work on the metabolism of bacteria. After his dismissal from his position in the April of 1933, he fled to Turkey the same year and began teaching in the Faculty of Medicine at Istanbul University as a full professor. The next year he was appointed as the director of the Institute of Microbiology and the Infectious Diseases and taught there until 1949. He and Caspari worked closely on the transfer of infectious diseases by insects, co-authoring several papers together. Braun was an extremely prolific scientist who published eight books in Turkish and about 175 articles in Turkish and in German. For his scientific biography, see [Unat, 1973].

Faculty of Sciences of Istanbul University [Geiringer and Kosswig [21], Appendix B].[34] And the third paper [Geiringer [19], Appendix B] was a purely theoretical one on the probability of arbitrarily linked events, which found its place in her widely discussed paper [Geiringer, 1944].[35] These three papers paved the way for a number of others, enabling Geiringer to pursue her research program fruitfully in the US. As a result, she was able to derive a system of recurrence formulae that yield the distribution of genotypes in the nth generation if their distribution in the previous generation and the "linkage distribution" are known and show how the distribution in the nth generation can be computed from the 0th generation using those formulae. The linkage distribution was directly related to the probability of arbitrarily linked events, hence the importance of [Geiringer [19], Appendix B].[36]

Interestingly, Prager too became intrigued by the idea of applying mathematics to genetics and co-authored a paper with the geneticist Alfred Heilbronn (Prager and Heilbronn [8], Appendix A).[37] We have then every reason to believe that Geiringer's and Prager's interest in this topic was kindled as a result of their interactions with their colleagues Heilbronn, Kosswig, Caspari and Braun who were teaching at Istanbul University during the same period.

It is also worth mentioning the contributions of von Mises, Prager, and Geiringer to the *Revue de la Faculté des Sciences l'Universite d'Istanbul*, *Nouvelle Serie*, the journal of the Faculty of Sciences of Istanbul University. This journal began its publication in 1935, and its first editorial committee consisted of Prager, physicists Marcel Fouche and Fahir Yeniçağ, and Şevket Aziz Kansu, a professor of anthropology. It had a multi-language policy of publication and was divided into Series A and B in 1940, where the former published articles exclusively in the fields of mathematics, physics and chemistry [İçen, 1982, 3–4]. The

[34] Kosswig (1903–82) and Geiringer were colleagues in the Faculty of Sciences during the same period. Kosswig studied at the University of Berlin and received his "Habilitation" at Münster University in 1927. Before joining Istanbul University in 1936, he was a professor of genetics at Braunschweig Technical University. He was appointed as the director of the Institute of Zoology at Istanbul University in 1937 and taught there until 1955. He had about a hundred publications and directed nine Ph.D. theses. He was awarded an honorary doctorate by Istanbul University for his contributions. İshakoğlu-Kadıoğlu [1998, 263–269] contains valuable and detailed information about his scholarly works and activities in Turkey. For a biographical sketch, see also the entry in tr.wikipedia.org/wiki/Curt_Kosswig.

[35] This is Geiringer's most cited publication. According to the Web of Science, there were 137 references to it as of 30 November 2011, the next most cited papers are the 1948, 1949 and 1945 publications with 21, 20 and 15 citations respectively as of the same date, and they still get cited, especially in papers in the theory of genetic algorithms.

[36] Geiringer's other papers on genetics include [Geiringer, 1945a, 1945b, 1948a, 1948b, 1949]. For a full list, see [Binder, 1992].

[37] At the time Heilbronn (1885–1961) was the director of the Institute of Pharmacobotany and Genetics in the Faculty of Sciences. He had received his Ph.D. in the field of botany from the University of Münster in 1921 and became the director of the Institute of Genetics there in 1923. He joined University of Istanbul in 1933 and taught there until 1960. He is credited with starting the modern instruction and research in genetics in Turkey. Like Kosswig, he too was very productive, publishing about 25 articles and five books. He directed eleven doctoral theses. Heilbronn and Kosswig also co-authored several articles on the principles of genetics. For a very informative documentation of Heilbronn's life and work, see [İshakoğlu-Kadıoğlu, 1998, 250–255]. See also [Demiriz, 1982] for the role Heilbronn and Kosswig played in the development of genetics and pharmacobotany in Turkey.

fact that Prager published more than a third of his scientific papers in this journal between 1935 and 1941 is a clear indication of how hard he worked to keep the journal alive, raise the quality of its publications and turn it into an international one [Prager [2], [5], [8], [11], [13], [14], Appendix A]. von Mises and Geiringer contributed two papers to it each [Mises, 1935–36, 1938–39], [Geiringer [10], [21] in Appendix B].[38] In addition, von Mises refereed articles, and his prestige was used in attracting international contributions. For example, Arthur Copeland, a well-known probabilist from Michigan University visited the Institute of Mathematics at Istanbul University in 1935 upon the invitation of von Mises and gave a lecture on "Admissible Numbers", which was published in [Copeland, 1936a].[39] Between 1935 and 1939, half of the articles in mathematics in this journal were published by Prager, von Mises and Geiringer and only a few by Turkish mathematicians. The number of articles by the latter gradually increased as Ph.D.'s began to be granted and the results of Ph.D. theses began to be published in the journal. Over the years, a number of other well-known mathematicians, such as Blaschke, du Val, Hadwiger, Hasse, Hernstein, Karamata, Nevanlinna, Santalo, Segre and Vincensini, also contributed to the journal.[40] In short, the journal played a very important role for the development of mathematics in Turkey.

Finally, we would like to point out that although there was some collaborative work between Prager, Geiringer, Heilbronn, and Kosswig, we came across no evidence of joint work of anyone with von Mises. However, apparently, von Mises and Prager did plan to cooperate to re-write the former's early textbook "Fluglehre" in English while both were in the USA, but Prager quit due to his other duties. von Mises completed the book with the help of Gustav Kuerti [Mises, 1945, vii–viii].

Shortly before the war began in 1939, first von Mises and then Geiringer left Turkey. As is well known, von Mises went to Harvard and contributed to the development of applied mathematics there. Geiringer found a job at Bryn Mawr in the US for a few years after being stranded in Lisbon for a brief period.[41] Prager, on the other hand, accepted the invitation of Brown University in 1941 and played a significant role in the founding of the Division of Applied Mathematics, competing with the Courant Institute at New York University. There were several reasons behind the departure of the trio from Turkey. The Turkish government did not extend Geiringer's contract. A disappointed von Mises left his job in protest. Brown promised much more attractive academic and financial conditions for Prager who suffered from the heavy teaching load and the lack of sufficient intellectual stimulation and whose efforts for obtaining Turkish citizenship failed. Mention should also be made of the fact that as the war neared, life became difficult for all German refugees [Reisman, 2006, 257–291]. The Nazi government starting putting pressure both on them and the Turkish government through diplomatic channels. Some of them, though not the academics, lost their passports or German citizenship [Taschau, 2002]. Atatürk died in 1938. The political mood began changing, "becoming more chauvinistic" as Maria Reichenbach, the wife of Hans Reichenbach put it [Güzeldere, 2005; Siegmund-Schultze, 2009a, 143–144].

[38] For a brief description of the contents of von Mises' articles, see [Kadıoğlu and Erginöz, 2011].
[39] The proofs of the results can be found in Copeland [1936b].
[40] All of these mathematicians with the exception of Hernstein also served as editorial board members.
[41] For an informative study of her life in the US, see [Binder, 1992].

5. The impact

Prager and von Mises left their marks on Turkish mathematics not only by publishing, but also by influencing their Turkish colleagues and training a number of Ph.D. students in applied mathematics and mechanics. It would be useful to begin by briefly describing their conception of applied mathematics and then turn to their impact on individual mathematicians. According to both von Mises and Prager, since any dividing line between pure and applied mathematics is bound to be arbitrary, it is impossible to give a precise and objective definition of applied mathematics. Nevertheless, both von Mises and Prager tried to provide a general characterization of this field [Mises, 1921; Prager, 1972]. For them, applied mathematics lies somewhere between pure mathematics and engineering: a pure mathematician is not interested in the applications of her work, and an engineer relies too heavily on experimental work. An applied mathematician, on the other hand, deals with practical problems like an engineer, but, unlike her, she aims to develops new mathematical tools with the rigor of a pure mathematician in order to solve them. Whereas the pure mathematician is interested in a theoretical problem with methodological purity, the applied mathematician employs all sorts of mathematical tools that would enable her to solve the practical problem at hand. Some typical problem areas of applied mathematics include, according to von Mises and Prager, problems of geodesics, descriptive geometry, numerical analysis, the problem of turbulence in hydrodynamics, and practical problems in mechanics, especially in elasticity and plasticity theory.

Applied mathematics as an autonomous academic field of systematic research and training did not exist in Turkey before the founding of the Institute of Mathematics in Istanbul University in 1933, but there was a tradition of teaching mathematics to engineering students in the College of Engineering, where Erim had begun his teaching career in 1917. He taught there continuously until 1946 while also teaching at Istanbul University from the beginning. For engineering students, mathematics was just a tool for solving practical problems, but Erim did not understand this to mean that one could compromise mathematical rigor or exactitude. For that reason, he was very receptive to the idea of applied mathematics, especially in the form advocated by von Mises and Prager. He was always open to new developments in the mathematical sciences and followed them closely, and one of the most important tasks he had set himself was to introduce them to the Turkish readers. Accordingly, he wrote extensively on, and taught courses in, the foundations of mathematics (especially Hilbert's program), relativity theory, and mechanics as applied mathematics [Dölen, 2010, vol. 3, 242–243; Bahadır, 2006, 55–58]. He was particularly interested in von Mises' works in the area of applied mathematics and mechanics. As we noted in Section 2, he had translated one of von Mises' papers on continuum mechanics into Turkish and published a series of brief articles exposing an iterative method developed by von Mises, today known as the "von Mises formula", for finding the zeros of functions, well before they became colleagues at Istanbul University.[42] It is telling that Erim chose to publish the latter with the title "Practical Methods for the Solution of Equations" in the journal of College of Engineering. It is no surprise then that Erim worked in harmony with both von Mises and Prager and was influenced by them when the latter joined Istanbul University.

[42] For references, see Footnote 16.

5.1. On Kerim Erim

Before the 1933 university reform, Kerim Erim published mostly in Turkish.[43] With the arrival of von Mises and Prager, this situation changed. Erim wrote eight scientific articles from 1939 to 1952, the year he died [İçen, 1982, 26]. An inspection of these articles reveals that three of them are directly related to the work done by von Mises and Prager.[44] Obviously, his interest in applied mathematics was growing to the extent of publishing original articles himself. In addition, he translated von Karman's lead article "Tooling up Mathematics for Engineering" that eloquently explains how applied mathematics serves empirical sciences, published in the first issue of the *Quarterly of Applied Mathematics* in 1943 [Erim, 1945]. Moreover, he took over von Mises' and Prager's Ph.D. students after they left Turkey. He of course also had his own Ph.D. students, some of whom wrote their dissertations extending the works of Prager and Mises. We discuss them below.

5.2. Ph.D. students[45]

The first Ph.D. theses completed in the Institute of Mathematics of the Faculty of Sciences at Istanbul University were supervised by von Mises, Prager, and Erim. In almost all of them the dissertation topics were directly related to von Mises' or Prager's areas of research. Here is a list of them:

(1) Yomtov Garti received his Ph.D. under the supervision of von Mises in 1939. He published his findings in [Garti, 1940], which is a generalization of initial distributions to n dimensions given in [Mises [4], Appendix C].[46]
(2) Terenzio Consoli also received his Ph.D. under the supervision of von Mises in 1939. The results of his Ph.D. work can be found in [Consoli, 1940]. This is a generalization of [Mises [2], Appendix C].[47]

[43] A notable exception is his contribution to the International Congress of Mathematics held in Italy in 1928. See [Erim, 1929], which is a summary of his findings in his doctoral work.
[44] As [İçen 1982, 229] points out, the following papers by Erim were influenced by von Mises and Prager: [Erim, 1940] is based on [Mises [3] and [5], Appendix C]. [Erim, 1948] shows a limitation of the Saint-Venant principle, following [Mises [8], Appendix C]. [Erim and Yüksel, 1952] is a follow up on [Prager and Symonds, 1950].
[45] A list of the mathematics Ph.D.s (together with the dissertation titles, the names of supervisors and the year each degree was awarded) from Istanbul University between 1933 and 1961 is given in [Günergün and Ata, 2007]. [İçen, 1982] provides a similar list for the period 1933–81. It also adds a list of the international publications of Turkish mathematicians for the same period and explains briefly the contribution of each. What follows in this subsection is based on them. Our own comments can be found in the footnotes.
[46] Garti had served as an assistant for a summer to Harry Dember, a professor in the Institute of Applied Physics then. After receiving his doctoral degree, he taught at Haydarpaşa, Galatasaray and Saint-Joseph high schools in Istanbul (personal communication). He died shortly after we interviewed him.
[47] Consoli began his career as a high school teacher at Notre Dame in Istanbul, but later left for France, where he joined the Atomic Energy Commission. Among other things, he contributed to the development of electrodeless plasma thruster. See http://en.wikipedia.org/wiki/Electrodes_plasma_thruster.

(3) Hermine Kalutsyan completed her Ph.D. under the supervision of von Mises and Prager in 1941. Her findings were published in [Kalutsyan, 1941].[48]
(4) Mehmet Anas received his Ph.D. under the supervision of Prager in 1941 and published his findings in [Anas, 1941].[49]
(5) Lütfi Biran also received his Ph.D. under the supervision of Prager in 1941. He published his findings [Biran, 1941, 1943].[50]
(6) Isaak Kapuano began his Ph.D. work under the supervision of Prager in 1941 and completed it in 1944. He published two papers before receiving his Ph.D. degree [Kapuano, 1941, 1944], and both indicate the influence of Prager.[51]

The next group of Ph.D. theses were all directed by Kerim Erim alone, except in one case where Ratip Berker was a co-supervisor, but the influences of Mises and Prager on them or the publications based on them can be seen clearly.

(7) Ferruh Şemin received his Ph.D. under the supervision of Erim in 1944. He published his results in [Şemin, 1941, 1942]. These were an extension of the ideas in [Mises [1], Appendix C].[52]
(8) Mahmut Tanrıkulu completed his Ph.D. under the supervision of Erim in 1945. His thesis topic was suggested to him by Prager, and Tanrıkulu wrote initial parts of his thesis under the guidance of Prager. He published his findings in two consecutive papers, [Tanrıkulu, 1948a, 1948b], which drew on [Mises [8], Appendix C].[53]

[48] In her paper Kalustyan thanks von Mises for giving the idea that led to her dissertation and Prager for helping her to complete it. She was the first woman to receive a Ph.D. degree in mathematics in Turkey. She studied mathematics at Ecole Normale Superieure between 1932 and 1936. After receiving her Ph.D., she taught at Galatasaray High school and served as the headmistress of Esayan high school in Istanbul between 1948 and 1973. In 1975 she moved to France. We thank Talin Budak providing this biographical information.
[49] Anas began his Ph.D. thesis under von Mises, but completed it under Prager, as the acknowledgment in his paper makes clear. He then went to Afghanistan and became the rector of Kabul University there [Arf, 1973].
[50] The latter paper appears to be based on [Mises [6], Appendix C]. Later on, Biran became a professor in the Institute of Mathematics at Istanbul University and also served as the dean of the Faculty of Sciences for a number of years.
[51] Soon after finishing his Ph.D., upon Cahit Arf's suggestion Kapuano became interested in problems of set theoretic nature and published a paper establishing the existence of an algebraically closed subfield of the complex number system, which is one-dimensional over the field of real numbers and contains no real transcendental numbers [Kapuano, 1946]. Later, he went to France and published 17 more articles in set theory and topology [Tezer, unpub.].
[52] Şemin became a professor in the Institute of Mathematics a year later and taught there until his retirement. For more about his academic life, including a list of his publications, see [İshakoğlu-Kadıoğlu, 1998, 297–298].
[53] He later became a professor at Istanbul Technical University. See the website of the Department of Mathematics of Istanbul Technical University at http://www.mat.itu.edu.tr/onceki_elemanlar.html.

(9) Feyyaz Gürsan received his Ph.D. degree under the supervision of Kerim Erim and Ratip Berker in 1946. He published his findings in [Gürsan, 1941].[54] He extended his results in [Gürsan, 1947]. Both papers bear the influence of [Mises [6], Appendix C].[55]
(10) Asım Özkan received his Ph.D. degree under the supervision of Kerim Erim in 1949 and published his findings in [Özkan, 1950]. The first part of this long paper is a follow-up on the work of Mehmet Anas mentioned above.[56]
(11) Halil Yüksel received his Ph.D. degree under the supervision of Kerim Erim in 1949. His dissertation was devoted to a study of Prager's theory of plasticity as the title of his Ph.D. thesis "On Prager's mathematical plasticity theory for compressible materials" indicates.[57]

In short, a total of eleven doctoral theses and more than a dozen publications that stem from them bear the influence of von Mises and Prager either directly or through Erim.

5.3. Other influences

Prager's relationship with Turkish mathematicians and his influence on them continued well after he left Turkey. Indeed, Brown University, where Prager accepted a professorship in 1941, became a magnet for a number of Turkish scientists. Consider, for example, Emin Turan Onat. Onat received his Ph.D., under the supervision of Ratip Berker, from Istanbul Technical University in 1951 by writing a thesis on the torsion of prismatic rods of work-hardening material [Kaya, 2007, 531]. This thesis, which was published in Turkish, was reviewed by Prager in Mathematical Reviews [Onat, 1951]. The relationship between the two deepened when Onat accepted a position as a researcher at Brown University, where he became a full professor in 1960. The Prager–Onat interaction resulted in six papers, five of which were jointly written [Onat and Prager, 1953a, 1953b, 1954a, 1954b, 1971]. In addition, Onat published a paper [Onat, 1954] that makes use of [Mises [7], Appendix C] that has been reworked by Prager later on [Prager [16], Appendix A]. At Brown, Onat also collaborated with Halil Yüksel, a Ph.D. from Istanbul University as we mentioned above, co-authoring at least one paper together [Onat and Yüksel, 1958]. Later, Onat moved to Yale as a professor of mechanical engineering in 1965 and taught there until his retirement.[58]

[54] In this paper Gürsan thanks von Mises for suggesting the problem and Prager for working with him.
[55] Gürsan became a professor at Istanbul Technical University [Uluçay and Kartekin, 1958].
[56] Özkan became a professor at Istanbul Technical University. See the website of the Department of Mathematics of Istanbul Technical University at http://www.mat.itu.edu.tr/onceki_elemanlar.html.
[57] Yüksel became a professor at Istanbul Technical University. To this long list of Ph.D.s Saffet Süray should be added as well even though he did not receive his doctoral degree from Istanbul University. Süray studied mathematics at Lille University and then joined the Institute of Mathematics at Istanbul University as an assistant in 1939. According to [İçen, 1982, 29], while an assistant there, he published two papers [Süray, 1941a, 1941b]. The topic of these papers, as Süray acknowledges, were suggested to him by Prager. We think that his doctoral thesis was based on them. He received his doctoral degree from Ankara University in 1949, where he became a professor of mathematics. We thank Okay Çelebi, who was Süray's student, for sharing this biographical information about him.
[58] For a biographical sketch, see [Ewing, 2000].

There are at least two other Turkish professors who followed Prager in the US: Bekir Tekinalp and Mahmut Tanrıkulu. Tekinalp completed his Ph.D. under the supervision of Mustafa İnan[59] at Istanbul Technical University in 1952 and then began teaching there. His paper on the hypercircle method of Prager and Synge clearly indicates the influence of Prager [Tekinalp, 1947]. He published several other papers in elasticity theory, at least one of which was reviewed by Prager himself [Tekinalp, 1952]. He later went to Brown as a visiting professor and collaborated with Walter Freiberger, a colleague of Prager [Tekinalp and Freiberger, 1956].[60] Tanrıkulu, on the other hand, visited Prager when the latter was at the University of San Diego, and they co-authored at least one paper together [Tanrıkulu and Prager, 1967].

We would like to close this subsection by saying a few words about the direction that mathematics took at the institutional level in Turkey from 30s onward. After von Mises, Prager and Geiringer left and Erim died, mathematics at Istanbul University turned more "pure", and the center of gravity in applied mathematics and mechanics shifted to Istanbul Technical University, which was founded in 1944 as a descendant of the College of Engineering. This new university provided a fertile ground for applied mathematics and mechanics to take firm root. Although this topic requires a study of its own, suffice it to say that a number of excellent mathematicians and able administrators such as Fikri Santur, Mustafa İnan and Ratip Berker played an important role in turning Istanbul Technical University into a strong institution of applied mathematics and mechanics.[61] The new university also provided attractive job opportunities for Ph.D.s from Istanbul University. Indeed, of the eleven Ph.D. students of von Mises, Prager and Erim, while two of them (Biran and Şemin) became professors at Istanbul University, four of them (Tanrıkulu, Özkan, Gürsan and Yüksel) became professors at Istanbul Technical University, carrying the influence of von Mises and Prager over to this new institution.

A clear indication of the fact that the center of gravity in applied mathematics and mechanics has shifted from Istanbul University to Istanbul Technical University is that while 29 Ph.D. degrees were awarded by the former between 1933 and 1965, a total of 36 Ph.D. degrees, most of which were in applied mathematics and mechanics, were awarded by the latter between 1944 and 1966 [İnönü, 1973, 29–33]. A quarter of these 36 Ph.D. theses were directed by İnan and Berker [Kaya, 2007]. We already mentioned Onat and Tekinalp and their scientific relationship with Prager. To them we must add Erdoğan Şuhubi who

[59] Mustafa İnan was an influential professor of mechanics at Istanbul Technical University. After graduating from Istanbul Technical University, he went to Zürich and received his doctoral degree from E.T.H. in 1941. He then returned to his Alma Mater and taught there until his death in 1967. He served as the dean of the faculty of civil engineering from 1954 to 1956 and as the rector of the university from 1957 to 1959. See his CV in the Bulletin of the Technical University of Istanbul, vol. 40, no. 4, vii–ix, 1987. For a discussion of his scientific contributions, see [Kayan, 1971].

[60] Freiberger is an established applied mathematician who has joined the Division of Applied Mathematics at Brown University in 1956 upon Prager's invitation after having written a Ph.D. thesis at Cambridge on continuum mechanics three years earlier. See his webpage at http://www.dam.brown.edu/people/facultypage.wf.html.

[61] Fikri Santur taught mechanics, geometry and many other topics from 1900 to 1943 at the College of Engineering and has been recognized as introducing modern mechanics to Turkey. He published numerous books in Turkish and also played a significant role in the founding of Istanbul Technical University. He discovered Mustafa İnan as a promising student and sent him to E.T.H.-Zurich to pursue a Ph.D. See [Yüngül, 1952] and [Altay and Dökmeci, 2000] for his contributions and publications.

received his Ph.D. under the supervision of İnan in 1959. In his Ph.D. thesis Şuhubi provided a general solution to the problem of minimum weight design of plates made of rigid-plastic and homogenous material, a solution that applies to arbitrary shapes and boundary conditions by using and extending the works of Prager, Geiringer, Tekinalp and Freiberger among others [Şuhubi, 1959]. He became one of the most prominent Turkish scientists and was elected to the Academy of Europe (Academia Europaea) in 1991 and to the Turkish Academy of Sciences as a founding member in 1993.[62]

This is not to say that research in applied mathematics has completely vanished from Istanbul University. In addition to Erim, Şemin and Biran, Cahit Arf carried out notable research in this field. Though trained as a pure mathematician, Arf published six papers between 1947 and 1954, in which he studied the problem of equilibrium of an elastic plane body under certain conditions (for a list of his publications, see [İçen, 1982, 22]. The story of how Arf became interested in this topic involves both Mustafa İnan and Prager. In his memoirs, Arf remembered vividly that this problem was suggested to him by Mustafa İnan around 1946, and he began working on it immediately. At the 1950 *International Congress of Mathematicians* held in *Cambridge, Massachusetts*, that he attended along with Erim, Berker and Şemin, he met Prager who introduced him to Alexander Weinstein of Maryland University. Through Weinstein, he received a fellowship at Maryland University and spent a productive year there, where he completed the work he had begun upon İnan's suggestion [Terzioğlu and Yılmaz, 2005, 76–79].

Nevertheless, the distinguished mathematician Arf's main interest was always in "basic" or "pure" mathematics. So was Patrick du Val's. The same was also true of a number of young and talented mathematicians, such as Orhan Alisbah, Orhan İçen, Giacomo Saban and Nazım Terzioğlu, who had obtained their Ph.D.'s from very good universities in Europe and joined Istanbul University.[63] This situation naturally created a stimulating environment in which pure mathematics flourished. It was upon attending one of du Val's seminar lectures that Arf, for example, was motivated to discover the famous rings and closure that now bear his name [Terzioğlu and Yılmaz, 2005, 73]. Add to this group of resident mathematicians the well-known visitors, such as Wilhelm Blaschke, Rolf Nevanlinna, and most famously Helmut Hasse, Arf's Ph.D. supervisor, who spent 2 years at Istanbul University in the early 50s, we get the picture of an institute which is in its research orientation very different from the 30s when the trio of von Mises, Prager and Geiringer dominated.[64]

These facts taken together leave no doubt that the scientific legacy of von Mises and Prager lived on in Istanbul Technical University, perhaps more so than in Istanbul University, from the 40s to the 60s and possibly beyond.

[62] See his webpage at http://math.yeditepe.edu.tr/people/suhubi/suhubi.html. Şuhubi taught at his alma mater from 1956 until his retirement in 2001 and then at Yeditepe University until 2011. He is still active in research. One of us, Gürol Irzik, had the good fortune of serving as his teaching assistant in analytical mechanics between 1979 and 1980 at Istanbul Technical University.

[63] For details, see [İnönü, 1973, 34–35; İçen, 1982, 23–35]. [Kadıoğlu and Erginöz, 2011] note that Terzioğlu was von Mises' assistant between 1937 and 1939.

[64] See [Terzioğlu and Yılmaz, 2005, 81, 88]. Blaschke spent the Winter and Summer semesters of the 1953–54 academic year at Istanbul University, teaching web and differential geometry, as we learn from the Turkish translation of his book on web geometry published by the Institute of Mathematics of Istanbul University in 1962.

5.4. The 1952 congress of theoretical and applied mechanics

Finally, we should mention the efforts of von Mises and Erim to bring the International Congress of the Theoretical and Applied Mechanics to Istanbul. Indeed, von Mises had started pushing the idea back in 1934, and finally during the 7th International Congress held in London in 1948, it was decided that the next one would take place in Istanbul.[65] Preparations started early in 1949, and Erim was appointed as the chairperson of the organizing committee, whose members included Cahit Arf, Lütfi Biran, Mustafa İnan, Nazım Terzioğlu and Ferruh Şemin among others, as well as of the executive committee consisting of himself, Cahit Arf and Giacomo Saban. The congress was held in Istanbul on 20–28 August, 1952, Istanbul University acting as the host. von Mises visited Istanbul in the March of that year, gave a series of talks at Istanbul University and was consulted on the details of the organization of the congress. Prager too went to Istanbul well in advance and helped with the preparations. It was a big conference with more than six hundred participants. The most famous of them was John von Neumann. Among the eminent scientists present were R. Courant, J.C. Hunsaker, G. Taylor, A. Kantorowitz, A. Lichnerowicz, W. Tollmien, J.M. Burgers, M. Reiner, G. Temple, F.N. Frenkiel, A. Signorini, M. Roy, N.T. Minorsky, and A. Ghizetti. von Mises, Prager and Geiringer were also among the participants, though von Mises, who was ill at the time, did not give a talk. The Congress was well attended by Turkish mathematicians and engineers. Indeed, following the United States, Turkey had the second largest number of participants. About 20 of them, including Arf, İnan, Onat, Yüksel, Tanrıkulu and famous physicists Feza Gürsey and Erdal İnönü (with P. Wigner) gave talks. Due to his illness, Erim was absent from the congress for the most part, but was able to make the closing speech and his contribution with Yüksel did appear in the proceedings [Erim and Yüksel, 1952]. The congress was a huge success both as a scientific and a social event, and it provided a clear sign of the level applied mathematics and mechanics had achieved in Turkey within a period of less than 20 years.[66]

6. Concluding remarks

Richard von Mises, William Prager and Hilda Geiringer were all quite productive, despite being uprooted from their homeland, in a foreign environment during uncertain times. Of the three, Geiringer appears to have benefited most from teaching at Istanbul University, which provided her an opportunity to interact with geneticists and thus to hit upon a successful research program of applying probability theory to Mendelian genetics. The three emigré mathematicians were lucky to have Kerim Erim as a colleague who played a crucial role in their successful stay at Istanbul University. All three had a significant impact on applied mathematics and mechanics in Turkey, an impact certainly magnified by Erim's efforts. Prager, von Mises, and Erim directed a total of eleven Ph.D. theses in applied mathematics and mechanics closely related to their own research interests. Given that within a period of almost 50 years (from 1933 to 1982) 41 doctoral degrees in mathe-

[65] For an account of bringing the congress to Istanbul, see [Siegmund-Schultze, unpub.].

[66] The information about the congress provided in this subsection is obtained from the proceedings of the congress, especially from the secretary's report. They appeared in two volumes, published by the Faculty of Sciences of Istanbul University in 1953 and 1955, respectively. Though the editorial committee officially consisted of Arf, Biran, İnan, Saban, and Terzioğlu, Ferruh Şemin shouldered most of the editorial task.

matics were awarded by Istanbul University[67], this makes up more than a quarter of them. Six of the eleven Ph.D. students became professors at Turkish Universities. In addition to the doctoral theses and publications based on them, the influences of von Mises and Prager were also seen in the works of a number of other Turkish scientists, including Erim, Süray, Bekiralp, Tanrıkulu, Şuhubi, and Onat, with some of whom Prager collaborated. There is then no doubt that the founding and the development of applied mathematics and mechanics in Turkey owed much to von Mises, Prager, Geiringer, Erim and their students.

In appreciation of his contributions, Istanbul University awarded von Mises an honorary doctorate degree at the end of the 1952 Congress. However, as this paper also suggests, of the three German mathematicians who taught in Istanbul between 1933 and 1941, Prager was the one who contributed most to the development of Turkish mathematics, and thus he deserved an honorary doctorate as much as von Mises did.

Acknowledgments

This paper grew out of a lecture delivered at a workshop entitled "German Mathematicians in Exile and the Founding of the Disciplines of Applied Mechanics and Mechanics in Turkey: 1933–1952" held at Boğaziçi University, Istanbul on 13 October 2011 and would not have been possible without the help of a number of people. We thank Yunus Söylet, the rector of Istanbul University, and Bakki Akkuş, the Dean of the Faculty of Sciences of Istanbul University, for allowing us to use the Istanbul University archives. We thank Nazım Sadıkov, the chairperson of the Department of Mathematics of Istanbul University, for his help in finding some of the mathematical literature for our research. We are grateful to Carol Hutchins of the Courant Institute at NYU for her guidance, Stephanie Schmeling of the NYU Archives for providing us with the Courant letters and to the late Kenneth W. Rose of the Rockefeller Archive Center for supplying us with Courant's preliminary report to the Turkish government and his letter to Lauder Jones of the Rockefeller Foundation in Paris, all quoted with permission. We are grateful to Şarlot Şefkat Abenyakar, Yomtov Garti's daughter, for sharing with us his father's lecture notes. We thank Hatice Ün and Zeliha Günday of Boğaziçi University Library, and Semra Özübek of Istanbul University Library for their generous help for supplying us with much of the literature for our research. We are grateful to Mehmet Budak, Sibylle Çizenel and Beniada Shabani for translating some of the letters and scientific papers in German and in Italian. We owe thanks to Meltem Akbaş, Talin Budak, Ahmet Okay Çelebi, Cengiz Dökmeci, Ahmet Feyzioğlu, the late Yomtov Garti, Feza Günergün, Esin İnan, Sevtap Kadıoğlu, Hasan Özoklav, Ayşe Soysal, and Hasan Yazıcı for their suggestions, help and advice. We are thankful to Cengiz Dökmeci, Tosun Terzioğlu and Erdoğan Şuhubi for their comments. Last but not least, we thank two anonymous reviewers and the editor for their helpful comments, and we are especially grateful to Reinhard Siegmund-Schultze for generously sharing with us his recent findings on this topic and for his thoughtful suggestions, criticisms and corrections. Needless to say, whatever errors remain are solely ours.

Appendix A. Prager's publications between 1934 and 1941

In English:

[1] with H. Geiringer, Mechanik isotroper Koerper im Plastischen Zustand. Ergebnisse d. Exakt. Naturwiss. 13, 310–363, 1934.
[2] Über die Reziprozität von Masse und Steifigkeit in der Schwingungslehre. Rev. Fac. Sci. Univ. Istanbul. 1, 37–43, 1935.

[67] For a complete list, see [İçen, 1982, 32–35].

[3] Der Einfluss der Verformung auf die Fliessbedingung Zahplastischer Körper. ZAMM. 15, 76–80, 1935.
[4] Elastic stability of plane frameworks. Journal of Aeronautical Sciences. 3, 388 1936.
[5] Die Knicksicherheit ebener Rahmentragwerke. Rev. Fac. Sci. Univ. Istanbul. 3, 1–10, 1937.
[6] Die Knicksicherheit ebener Rahmentragwerke. Appl. Math. Mech., Moscow, 1, 15–23, 1937.
[7] Über Systeme von Kurvenkongruenzen. Bull. Math. Soc. Roum. Sci. 40, 187–192, 1937.
[8] With A. Heilbronn, Beiträge zum Mutationproblem (Erste Mitteilung). Rev. Fac. Sci. Univ. Istanbul. 37–43, 1937.
[9] Mecanique des solides isotropes au dela du domaine elastique. Memorial des Sciences Mathématiques, L'Academie des Sciences de Paris, Gauthier-Villars, Paris, 1937.
[10] Ebene elastische Spannungszustände mit konstanter Hauptschubspannung. Revue Mathematique L'Union Interbalkan. 2, 45–52, 1938.
[11] On Hecky-Prandtl Lines. Rev. Fac. Sci. Univ. Istanbul 4, 22–24, 1938–39.
[12] On Isotropic materials with continuous transition from elastic to plastic state. Proc. 5th Int. Congr. Appl. Mech. 234–237, 1939.
[13] On an analogy between the fundamental equations of hydrodynamics and elastostatics. Rev. Fac. Sci. Univ. Istanbul (A). 5, 41–43, 1940.
[14] A new mathematical theory of plasticity. Rev. Fac. Sci. Univ. Istanbul (A). 5, 215–226, 1941.
[15] A new mathematical theory of plasticity. J. Appl. Math. Mech. (Akad. Nauk SSSR, Zhurnal Prikl. Mat. Mech.) 5, 419–430, 1941.
[16] Streamlines and lines of principal stress. Revue Mathematique Union Interbalkan. t.III, f.I–II, 63–65, 1941.

In Turkish:

[17] Riyazi Mihanik (Mathematical Mechanics), Istanbul, 1935.
[18] "Tayyareciliğin esasları", Üniversite Konferansları 1937–38, Istanbul Üniversitesi Yayınları, 1939, pp. 153–164.
[19] Tersimi Hendese (Projective/descriptive geometry), two volumes, v.1 with Nakibe Topuz and Yavuz Kansu, Istanbul 1937; v.2 with Feyyaz Gürsan and Nakibe Topuz, Istanbul, 1940.
[20] "Harp tayyarelerinin imalinde ilmi problemler", Üniversite Konferansları 1940–1941, Istanbul Üniversitesi Yayınları, 1941, pp. 172–183.
[21] Mekaniğe Giriş (Introduction to Mechanics), with Feyyaz Gürsan, Istanbul 1941.

Appendix B. Geiringer's publications between 1934 and 1941

In English:

[1] with W. Prager, Mechanik isotroper Koerper im Plastischen Zustand. Ergebnisse d. Exakt. Naturwiss., 13, 310–363, 1934.
[2] Korrelationsmodelle. Z. f. angew. Math. und Mechanik ZAMM. 14, 19–35, 1934.
[3] Methoden der theoretischen Statistik. Compositio Math. 2, 276–320, 1935.

[4, 5] Une nouvelle méthode de statistique théorique (problèmes à deux dimensions). Bull. Acad. Bruxelles Cl. Sci. 21, 157–165, 307–324, 1935.
[6] Zur Verwendung der mehrdimensionalen Normalverteilung in der Statistik. 2. Mitteilung. Monatsh. Math. Phys. 44, 97–112, 1936.
[7] Zur Verwendung der mehrdimensionalen Normalverteilung in der Statistik. 1. Mitteilung. Monatsh. Math. Phys. 43, 425–434, 1936.
[8,9] Zur Verwendung der mehrdimensionalen Normalverteilung in der Statistik. I, II. Mh. Math. Phys. 43, 425–434, 1936; 44, 97–112, 1936.
[10] Zur Weinbergschen Probandenmetode. Rev. Fac. Sci. Univ. Istanbul. 1, 10–36, 1936.
[11] Fondements mathematiques de la theorie des corps plastiques isotropes. Memorial Sci. Math. No. 86, Gauthiers-Villars, Paris, 1937.
[12] Sur les variables aleatoires arbitrairement liees (convergence vers la loi de Poisson). C.R. Acad. Sci. Paris. 204, 1914–1915, 1937.
[13] Sur les variables aleatoires arbitrairement liees. Cas de convergence vers la loi de Gauss. C.R. Acad. Sci. Paris. 204, 1856–1857, 1937.
[14] Sur les variables aleatoires arbitrairement liees. Rev. Math. Union Interbalkan. 2, 1–26, 1938.
[15] Über die Wahrscheinlichkeit von Hypothesen. Erkenntnis. 8, 151–176, 1939.
[16] Bemerkungen zur Hypothesenwahrscheinlichkeit. Erkenntnis. 8, 352–353, 1939.
[17] Bemerkung zur Wahrscheinlichkeit nicht unabhängiger Ereignisse. Rev. Math. Union Interbalkan. 2, 1–7, 1939.
[18] La répartition des groupes sanguins de deux races en cas de croisements. Rev. Fac.Sci. Univ. Istanbul. 6, 1–12, 1939.
[19] On the probability theory of arbitrarily linked events (with Errata). Ann. Math. Statistics. 9, 260–271, 1938; 10, 202, 1939.
[20] A generalization of the law of large numbers. Ann. Math. Statistics. 11, 393–401, 1940.
[21] With C. Kosswig, Calculs sur la transformation de la heterogametiemale en heterogematie femalle. Rev. Fac. Sci. Univ. Istanbul (A). 6, 44–55, 1941.
In Turkish:
[22] Yüksek Matematiğe Giriş (Introduction to Calculus), prepared by Hermine Kalutsyan, n. p. Istanbul, 1939.

Appendix C. von Mises' articles that influenced mathematicians in Turkey

[1] Zur konstruktiven Infinitesimalgeometrie der ebenen Kurven. Z. Math. Phys. 52, 44–85, 1905.
[2] Generalisation d'un theoreme sur la probabilite d'une somme infinie. Actes Congress Interbalkan. Math. 201–209, 1934.
[3] Über allgemeine Quadraturformeln. J. f. Reine u. Angew. Math. 174, 56–67, 1935.
[4] Les lois de probabilité pour les fonctions statistiques. Ann. Inst. Henri Poincare. 6, 185–212, 1936.
[5] Formules de cubature. Revue Mathem. De l'Union Interbalkan. 1, 17–27, 1936.
[6] L'element infinitesimal d'ordre n d'une courbe gauche. C. R. De l'Acad. Des. Sei. Paris. 206, 1338–1340, 1938.

[7] Über den singulären Punkt zweiter Ordnung im ebenen Spannungsfeld. In: (no ed.) Stephen Timoshenko 60th Anniversary Volume, Macmillan, New York, 1938, pp. 147–154.
[8] On Saint-Venant's principle. Bulletin of American Mathematical Society. 51, 555–562, 1945.

References

Akbaş, M., 2003. Einstein'ın görelilik teorisini Türkiye'ye tanıtanlar (I): Mehmed Refik Fenmen ve Kerim Erim. Osmanlı Bilimi Araştırmaları IV (2), 49–52.
Altay, G., Dökmeci, C., 2000. Cumhuriyet Dönemi'nin 75. Yılında Mekaniğin Gelişimine İlişki Ön Bilgiler. Türkiye Cumhuriyeti'nin 75. Yılında Bilim, II. kitap II. Cilt, Ankara, pp. 91–107.
Anas, M., 1941. Surfaces dont le second Beltramien relatif à la courbure moyenne est nul. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 154–188.
Arf, C., 1973. Istanbul üniversitesindeki matematik çalışmaları hakkında bazı izlenimler ve anılar. In: İnönü, E., 1923–1966 Dönemi Türkiye Matematik Araştırmaları Bibliyografyası ve Bazı Gözlemler. Orta Doğu Teknik Üniversitesi Yayını, Ankara, pp. 37–44.
Aras, N.K., Dölen, E., Bahadır, O., 2007. Türkiye'de Üniversite Anlayışının Gelişimi 1861–1961. Türkiye Bilimler Akademisi Yayınları, Ankara.
Bahadır, O., 2006. Matematikte bir Öncü: Kerim Erim. Anahtar Yayınları, Istanbul.
Berker, R., 1963. Intégration des équations du mouvement d'un fluide visqueux incompressible. Handbuch der Physik. Bd. VIII/2. Springer, Berlin, pp. 1–384.
Bilsel, C., 1943. Istanbul Üniversitesi Tarihi. Kenan Basımevi, Istanbul.
Binder, C., 1992. Hilda Geiringer: ihre ersten Jahre in Amerika. In: Demidov, S., Folkerts, M., Rowe, D., Scriba, C. (Eds.), Amphora. Birkhauser, Basel, pp. 25–53.
Biran, L., 1941. Les surfaces réglées etudiees en analogie avec les courbe gauches. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 121–134.
Biran, L., 1943. Représentation géométrique des propriétés intrinsèques d'une courbe gauche. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 8, 339–344.
Consoli, T., 1940. Généralisation d'un théorème sur la probabilité de la somme d'un nombre infini de variables aléatoires. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 5, 1–17.
Copeland, A., 1936a. Admissible numbers. Revue de la Faculté des Sciences de l'Université d'Istanbul 1, 52–57.
Copeland, A., 1936b. Point set theory applied to the random selection of the digits of an admissible number. American Journal of Mathematics 58, 181–192.
Demiriz, H., 1982. Fen fakültesinin botanik alanındaki araştırmalara ve öğretime katkısı. In: Özemre, A.Y. (Ed.), Istanbul Üniversitesi Fen Fakültesi'nde Çeşitli Fen Bilimi Dallarının Cumhuriyet Dönemindeki Gelişmesi ve Milletlerarası Bilime Katkısı. Nazım Terzioğlu Matematik Araştırma Merkezi Baskı Atölyesi, Istanbul, pp. 121–141.
Dölen, E., 2009. In: Türkiye Üniversite Tarihi, vol. 1. Istanbul Bilgi Üniversitesi Yayınları, Istanbul.
Dölen, E., 2010. In: Türkiye Üniversite Tarihi, vol. vols. 2–5. Istanbul Bilgi Üniversitesi Yayınları, Istanbul.
Erim, K., 1929. Über die Trägheitsformen eines Modulsystems. Atti del Congresso Internazionale dei Matematici: Bologna del 3 al 10 de settembre di 1928, vol. 2, (Comunicazioni, sezione I (A-B)), pp. 51–56.
Erim, K., 1930. Muadelatın hallinde pratik usuller. Yüksek Mühendis Mektebi Mecmuası 4 (48), 1008–1023, 5(49–50), 67–80, 5(51), 114–127.
Erim, K., 1931. Klasik kontinuum mihanikinin şimdiye kadarki faraziyelerine dair. Yüksek Mühendis Mektebi Mecmuası 52, 163–173.

Erim, K., 1940. Über die Darstellung mehrfacher Integrale. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 5, 191–214.
Erim, K., 1945. Mühendisliğe alet olarak matematik. Istanbul Teknik Üniversitesi Dergisi 3, 12–16.
Erim, K., 1948. Sur le principe de Saint-Venant. In: Proceedings of the 7th International Congress of Applied Mechanics, vol. 1, pp. 28–32.
Erim, K., Yüksel, H., 1952. Some remarks on elastic-plastic trusses. In: Proceedings of the 8th Congress of Theoretical and Applied Mechanics, vol. 1. Faculty of Sciences of Istanbul University, Istanbul, pp. 230–232.
Ewing, M., 2000. Remarks on the Life of Emin Onat. Retrieved 11 November 2011. Available from: <http://ewing.aa6e.net/msewing/eto/calhoun_remarks.html>.
Garti, Y., 1940. Les lois de probabilité pour les fonctions statistiques (cas de collectifs à plusieurs dimensions). Revue Mathématique de l'Union Interbalkanique 3, 21–39.
Geiringer, H., 1944. The probability theory of linkage in Mendelian heredity. The Annals of Mathematical Statistics 15, 25–57.
Geiringer, H., 1945a. Further remarks on linkage theory in Mendelian heredity. The Annals of Mathematical Statistics 16, 390–393.
Geiringer, H., 1945b. On the definition of distance in the theory of the gene. The Annals of Mathematical Statistics 16, 393–398.
Geiringer, H., 1948a. Contributions to the heredity theory of multivalents. Journal of Mathematics and Physics 16, 246–278.
Geiringer, H., 1948b. On the mathematics of random mating in case of different recombination values for males and females. Genetics 33, 548–564.
Geiringer, H., 1949. Chromatic segregation of tetraploids and hexaploids. Genetics 34, 565–694.
Georgiadou, M., 2004. Constantin Carathéodory: Mathematics and Politics in Turbulent Times. Springer, Berlin-Heidelberg.
Grossbach, U., 2009. Seventy-five years of developmental genetics: Ernst Caspari's early experiments on insect eye pigmentation, performed in an academic environment of political suppression. Genetics 181, 1175–1182.
Günergün, F., Ata, K., 2007. Istanbul Üniversitesi'nde araştırmanın kurumsallaşması: 19 33 reformunu izleyen otuz yıl içinde yapılan doktoralar. In: Aras, N.K., Dölen, E., Bahadır, O. (Eds.), Türkiye'de Üniversite Anlayışının Gelişimi 18 61–19 61. Türkiye Bilimler Akademisi Yayınları, Ankara, pp. 163–189, and 501–517.
Gürsan, F., 1941. L'élément infinitésimal d'ordre supérieur d'une courbe gauche. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 27–35.
Gürsan, F., 1947. Les elements d'ordre supérieur d'une courbe gauche. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 12, 230–236.
Güzeldere, G., 2005. An interview with Maria Reichenbach and David Kaplan. In: Irzik, G., Güzeldere, G. (Eds.), Turkish Studies in the History and Philosophy of Science. Springer, Dorrecht, pp. 7–24.
Irzik, G., 2011. Hans Reichenbach in Istanbul. Synthèse 181, 157–180.
İçen, O., 1982. Istanbul Üniversitesi fen fakültesi matematik dalı mensuplarının uluslararası bilimsel araştırmalara yaptıkları katkı. In: Özemre, A.Y. (Ed.), Istanbul Üniversitesi Fen Fakültesi'nde Çeşitli Fen Bilimi Dallarının Cumhuriyet Dönemindeki Gelişmesi ve Milletlerarası Bilime Katkısı. Nazım Terzioğlu Matematik Araştırma Merkezi Baskı Atölyesi, Istanbul, pp. 1–35.
İnönü, E., 1973. 1923–1966 Dönemi Türkiye Matematik Araştırmaları Bibliyografyası ve Bazı Gözlemler. Orta Doğu Teknik Üniversitesi Yayını, Ankara.
İshakoğlu-Kadıoğlu, S., 1998. Istanbul Üniversitesi Fen Fakültesi Tarihçesi (1900–1946). Istanbul Üniversitesi Basımevi, Istanbul.
Kadıoğlu, S., Erginöz, G.Ş., 2011. An emigrant scientist in Istanbul University: Richard Martin Edler von Mises (1883–1953). Almagest 2, 102–123.
Kalutsyan, H., 1941. Représentation conforme et mouvement d'un plan sur un plan. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 135–143.

Kapuano, I., 1941. Sur une nouvelle propriétée des réseaux de Hencky-Prandtl. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 36–39.
Kapuano, I., 1944. Sur les réseaux de Hencky-Prandtl. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 9, 35–60.
Kapuano, I., 1946. Sur les corps de nombres à une dimension distincts du corps réel. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 11, 30–39.
Kaya, H., 2007. Istanbul Teknik Üniversitesi'nde yapılan doktoralar (1949–1961). In: Aras, N.K., Dölen, E., Bahadır, O. (Eds.), Türkiye'de Üniversite Anlayışının Gelişimi 1861–1961. Türkiye Bilimler Akademisi Yayınları, Ankara, pp. 530–534.
Kayan, İ., 1971. Prof. Dr. Mühendis Mustafa İnan'ın bilimsel kişiliği ve eserleri. In: Prof. Dr. Mustafa İnan Anısına, Arı Kitapevi, Istanbul, pp. 1–11.
Mises, R. von, 1913. Mechanik der festen Körper im plastisch-deformablen Zustand, Nachrichten von der Köngl. Gesellschaft der Wissenschaften zu Göttingen, Mathematisch-Physikalische Klasse pp. 582–592.
Mises, R.von, 1919. Grundlagen der Wahrscheinlichkeitrechnung. Mathematische Zeitschrift 5, 52–99.
Mises, R.von, 1921. Über die Aufgaben und Ziele der angewandten Mathematik. Zeitschrift für Angewandte Mathematik und Mechanik 1, 1–15.
Mises, R. von, 1930. Über die bisherigen Ansätze in der klassischen Mechanik der Kontinua, Verhandlungen des 3. Internationalen Kongresses für Technische Mechanik, 1930, II, pp. 3–11.
Mises, R.von, 1931. Über die Weinbergsche 'Geschwistermethode'", Assekuranz Jahrbuch, herausg. Von S.J. Lengyel, Wien-Leipzig, pp. 40–52.
Mises, R.von, 1935–36. Deux nouveaux theoremes de limite dans le calcul des probabilités. Revue de la Faculté des Sciences de l'Université d'Istanbul 1, 61–80.
Mises, R.von, 1938–39. Über Aufteilungs- und Besetzungswahrscheinlichkeiten. Revue de la Faculté des Sciences de l'Université d'Istanbul 4, 145–163.
Mises, R.von, 1939. Açılış dersi, üniversite konferansları 1937–38. Istanbul Üniversitesi Yayınları, Istanbul, pp. 12–20.
Mises, R.von, 1945. Theory of Flight. McGraw-Hill, New York.
Mises, R.von, 1951. Positivism. Harvard University Press, Cambridge.
Mises, R. von, 1963–64. Selected Papers of von Mises, 2 vols. American Mathematical Society, Providence, Rhode Island.
O'Connor, J.J., Robertson, E.F., 2005. Prager. Retrieved 8 November 2011. Available from: <http://www.gap-system.org/~history/Biographies/Prager.html>.
Onat, E.T., 1951. Pekleşen malzemeden mamul prizmatik çubukların burulması. Istanbul Technical University, Kutulmus Basımevi, Istanbul.
Onat, E.T., 1954. On the singular points in a field of plane elastic stress. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 19, 3–7.
Onat, E.T., Prager, W., 1953a. Limit analysis of arches. Journal of the Mechanics and Physics of Solids 1, 77–89.
Onat, E.T., Prager, W., 1953b. Limit analysis of arches. In: Proceedings of the 8th Congress of Theoretical and Applied Mechanics, vol. 1. Faculty of Sciences of Istanbul University, Istanbul, p. 230.
Onat, E.T., Prager, W., 1954a. Limit analysis of shells of revolution. Koninklijke Nederlandse Akademie van Wetenschappen. Proceedings. Series B. Physical Sciences 57, 534–548.
Onat, E.T., Prager, W., 1954b. The necking of a tension specimen in plane plastic flow. Journal of Applied Physics 25, 491–493.
Onat, E.T., Prager, W., 1971. Stresses and strains in nosing of tubes. In: Prof. Dr. Mustafa İnan Anısına. Arı Kitabevi Matbaası, Istanbul.
Onat, E.T., Yüksel, H., 1958. Elastic, plastic stresses in free plate with periodically varying surface temperature. Journal of Applied Mechanics 25, 603–606.

Özkan, A., 1950. Les surface réelles pour lesquelles la seconde beltramienne de la courbure moyenne ou de la courbure de Gauss est nulle. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 15, 213–288.

Prager, W., 1942. Fundamental theorems on a new mathematical theory of plasticity. Duke Mathematical Journal 9, 228–233.

Prager, W., 1972. Introductory remarks. Quarterly of Applied Mathematics XXX, 1–9.

Prager, W., Symonds, P.S., 1950. Stress analysis in the elastic–plastic structures. In: Proceedings of the Symposium on Applied Mathematics, vol. 3, pp. 187–197.

Reid, C., 1996. Courant. Copernicus, New York.

Reisman, A., 2006. Turkey's Modernization: Refugees from Nazism and Atatürk's Vision. New Academia Publishing, Washington, DC.

Schwartz, P., 2003. Kader Birliği. Belge Yayınları, Istanbul. (N. Alçı, Trans.). Originally published as *Notgemeinschaft*: Zur Emigration deutscher Wissenschaftler nach 1933 in die Türkei. Metropolis-Verlag, Marburg, 1995.

Siegmund-Schultze, R., 1993. Hilda Geiringer-von Mises, Charlier series, ideology, and the human side of the emancipation of applied mathematics at the University of Berlin during the 1920s. Historia Mathematica 20, 364–381.

Siegmund-Schultze, R., 2004. A non-conformist longing for unity in the fractures of modernity: towards a scientific biography of Richard von Mises (1883–1953). Science in Context 1, 333–370.

Siegmund-Schultze, R., 2009a. Mathematicians Fleeing from Nazi Germany. Princeton University Press, Princeton.

Siegmund-Schultze, R., 2009b. Richard von Mises (1883–1953): a pioneer of applied mathematics in four countries. Newsletter of the European Mathematical Society 73, 31–34.

Siegmund-Schultze, R., unpub. Richard von Mises in Istanbul: His politics for science and mathematics in a foreign environment. Lectured delivered on 13 October 2011, Boğaziçi University, Istanbul, Turkey.

Süray, S., 1941a. Sur les lignes de tension principale. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 40–43.

Süray, S., 1941b. Sur les lignes de tension principale dont une famille est constituée de lignes droites. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 83–87.

Şemin, F., 1941. Géométrie infinitésimale des systémes variables à un paramètre. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 6, 62–82.

Şemin, F., 1942. Géométrie infinitésimale des systèmes variables à un paramètre. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 7, 20–40.

Şuhubi, E., 1959. Minimum ağırlıklı plaklar. Istanbul Teknik Üniversitesi İnşaat Fakültesi, Kurtulmuş Matbaası, Istanbul.

Tanrıkulu, M., 1948a. Ordinary zero places in a body under plane stress. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 3, 205–235.

Tanrıkulu, M., 1948b. Ordinary zero places in a body under plane stress. Revue de la Faculté des Sciences de l'Université d'Istanbul (A) 3, 246–302.

Tanrıkulu, M., Prager, W., 1967. On the construction of Hermitians from Lagrangian difference approximations. Quarterly of Applied Mathematics 24, 371–373.

Taschau, F., 2002. German Jewish Emigrés in Turkey. In: Levy, A. (Ed.), Jews, Turks. Syracuse University Press, Syracuse, Ottomans, pp. 233–245.

Taşdemirci, E., 1992. Belgelerle 1933 Üniversite Reformunda Yabancı Bilim Adamları. Ankara.

Tekinalp, B., 1947. The hypercircle method of Prager and Synge. Quarterly of Applied Mathematics 5, 241–269.

Tekinalp, B., 1952. Generalisation of the conjugate beam method to space rods. Bull. Tech. Univ. Istanbul 4, 29–36.

Tekinalp, B., Freiberger, W., 1956. Minimum weight design of circular plates. Journal of the Mechanics and Physics of Solids 4, 294–299.

Terzioğlu, T., Yılmaz, A., 2005. Anlamak Tutkunu bir Matematikçi: Cahit Arf. Türkiye Bilimler Akademisi Yayınları, Ankara.

Tezer, C., unpub. Turkey 1933–1952: A questionable refuge for German mathematicians in exile. Lectured delivered on 13 October 2011, Boğaziçi University, Istanbul, Turkey.

Tyrell, J.A., 1989. Obituary of Patrick du Val. Bulletin of the London Mathematical Society 21, 93–99.

Uluçay, Ç., Kartekin, E., 1958. Yüksek Mühendislik Okulu. Berksoy Matbaası, Istanbul.

Unat, E.K., 1973. Ölümünün onuncu yılında Ord. Prof. Dr. H. Braun'ı hatırlayış. Cerrahpaşa Tıp Fakültesi Dergisi 4, 294–310.

Widmann, H., 1999. Atatürk ve Üniversite Reformu. Kabalcı Yayınevi. Istanbul. (A. Kazancıgil and S. Bozkurt, Trans.) Originally published as Exil und Bildungshilfe. Herbert Lang, Bern, 1973.

Yu, M., 2002. Advances in strength theories for materials under complex stress state in the 20th Century. Applied Mechanics Review 55, 169–218.

Yüngül, N., 1952. Ordinaryüs profesör Fikri Santur (1878–1951): Hayatı, Şahsiyeti, Eserleri. In: Ord. Prof. Fikri Santur'un Hatırasına. Istanbul Teknik Üniversitesi İnşaat Fakültesi, Kurtuluş Basımevi, Istanbul, pp. 1–18.