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IN MEMORIAM

PROFESSOR FRANCISC RADÓ

(1921–1990)

FRANCISC RADÓ was born on May 21, 1921 in Timişoara (Romania), where he got his primary and secondary education at jewish schools. He inherited his mathematical talent from his father Arthur Radó, a railway engineer with great interest in mathematics, who has had some original contributions in algebra. The father disclosed for his son the beauties of mathematics, conducted his steps in this direction and had long discussions with him on mathematical problems. In 1939 F. RADÓ succeeded to enter the Engineering School in Bucharest, occupying the third position at the admission exam among thousands of candidates.

After one year of study he was forbidden to continue his studies. It followed one idle year and three years of labour camp. The conditions were hard, nevertheless he didn't interrupt to study mathematics, usually hidden behind heaps of excavated earth.

In 1944, in the new romanian regime he was accepted as a student again; switched to study mathematics and got his degree in January 1946 at the University of Cluj. Until the end of 1949 he taught mathematics in Timişoara, first at the Jewish Lyceum, where he once was a school boy, and then, after the nationalization of schools in 1948, he joined a state secondary school. He was also appointed as assistant professor at the newly founded Pedagogical Institut in Timişoara during one academic year.

In January 1950 he was nominated at the Bolyai University in Cluj. In 1959, the two universities in Cluj (with teaching languages romanian and hungarian, respectively) were united to from the Babeş-Bolyai University, where RADÓ was active until his retirement in 1985 (from 1969 as full professor). Between 1951 and 1968 he also held a second position as research scientist at the Academic Institut for Computation in Cluj. He taught during the 1969–70 academic year at the University of Waterloo (Canada) as visiting professor on the invitation of Professor J. Aczél.

His primary interest was algebraic foundations of geometry. Prior to this he studied nomographic representability related to the theory of webs and functional equations (his PhD thesis in 1959 belongs to this domain), then the embedding conditions of a semi-web into a Reidemeister web. He continued with noninjective collineations of two Desarguesian projective planes, which led him to ring geometry. Under W. Benz's influence he became very interested in characterizing isometries of metric vector spaces with as weak assumptions as possible. He also obtained remarkable results in mathematical programming.

At the university he taught geometry, algebra, theory of numbers and theory of complex functions. He published several courses in geometry and exercise books. Wrote jointly with B. Orbán the book ,,Geometry under modern view point'' in hungarian language, showing how various euclidean, affine, projective and reflexion geometries and their algebraic counterparts are interweaved. In a review on this book Professor F. Kárteszi wrote: ,,Such an ample treatment of the subject promised in the title didn't appear till now in hungarian. Moreover, such a thorough examination of the relations among the presented structures didn't occur in any other language either'' (Az Eötvös Loránd Tudományegyetem Természettudományi Karának Szakmódszertani Közleményi XIV/1, Budapest, 1981). For his scientific and teaching activity RADÓ was awarded prizes by the Romanian Ministry of Education in 1960, 1967 and 1981.

In 1952 he married Martha Gidáli, one of his students. During the years to come they worked together on aspects of modernizing the teaching of geometry and had an essential contribution in writing new geometry manuals for the secondary school. Martha succeeded in ensuring favourable conditions to thorough scientific work. Their two daughters took up careers in computer science.

Professor RADÓ is among the editors of ,,Journal of Geometry'' (rigth from the start) and of ,,Aequationes Mathematicae''. More than 20 years he acted as reviewer for ,,Mathematical Reviews'' and ,,Zentralblatt für Mathematik''.

He gave talks at Universities in Bucharest, Iassy, Timişoara, Budapest, Debrecen, Giessen, Bochum, Waterloo, Montreal, Hamilton, Buffalo, Frankfurt, Pavia, Hamburg, Hannover, Braunschweig, München, Kiel, Duisburg, Oldenburg, Toronto, Pittsburgh, New York (Courant Institut), Brockport, New Brunswick, Tel Aviv and Haifa. In July 1982 he spend one month at the University of Hamburg being sponsored by W. Blaschke Fund, on the recommendation of Prof. Benz. In 1985, on the invitation of Prof. Aczél he acted as a visiting research scientist at the University of Waterloo for two months. He presented from his original researches on a series of mathematical meetings and symposiums, but was prohibited to attend many others due to the ever increasing restrictions imposed by the Ceauşescu government. Moreover, he couldn't go to the 1972 meeting on Higher Geometry, held in Oberwolfach, in spite of the fact that he was one of the organizers.

Some of Professor RADÓ's scientific results:

His studies in nomography comprise: i) criteria for various nomographic representability in terms of functional equations without differentiability assumptions (1959); ii) projective transformation of alignment nomograms in order to obtain minimal error. He showed that for a nomogram in a projective family to be optimal it is necessary and sufficient that the points of maximal error on each scale fulfil a specific geometric condition (1964, 1969). Studies in this direction were continued by B. Orbán, V. Groze, A. Vasiu.

He generalized Malcev's theorem concerning the conditions for a semigroup to be injectively embeddable into a group. Giving to this problem a geometric form he established necessary and sufficient conditions for a semi-web to be injectively embeddable in a regular web (satisfying Reidemeister's condition). This is not only a more general result, but the rather sophisticated Malcev's chains appear in a simpler and natural manner (1965).

Let S be a non-singular incidence structure such that to any point A and any line L there exists a point P and a line D with $A \in D$, $P \in D$, $P \in L$. Then S can be injectively imbedded in a projective plane with given general closure condition C if and only if all ,,projective conclusions'' of C hold in S (1969).

A fundamental theorem of projective geometry states that any injective collineation of two projective spaces over fields K and K' respectively, is induced by a semi-linear mapping of the underlying vector spaces, related to certain monomorphism $s: K \to K'$. In 1956 W. Klingenberg has extended this theorem for non-injective collineations of spaces of finite dimension. The role of s is taken by a place (valuation morphism); he worked with coordinates. RADÓ has generalized Klingenberg's theorem to projective spaces of arbitrary dimension, by suitable adjusting Artin's method, instead of using coordinates (1969). This method was aferwards applied in many situations, especially for ring geometries by K. Mathiak, J. Brandstetter, P. Hartmann, F. Machala, H. Havlicek and others. Related to these ideas is also RADÓ's following result.

Let P and P' be Desarguesian projective planes and C a subset of P which contains three) non-concurrent lines and a point not incident with them. Then any (non necessarily injective) collineation of C into P' can be uniquely extended to a collineation of P into P' (1970). Severa refinements and generalizations of this theorem are due e.g. to B. Orbán and J. L. Zemmer; D. S. Carter and A. Vogt have given a thorough study on collinearity-preserving mappings between Desarguesian planes.

RADÓ also gave an example of a valuation of a skew-field such that the corresponding valuation ring is non invariant. Thus, in Schilling's definition the invariance of the valuation ring is not a consequence of the other axioms (1970).

In a joint paper by Aczél, Djoković, Kannappan and RADÓ, the contribution of RADÓ is the following: Let G, H be groups, S a subsemigroup of G such that $G = S \cdot S^{-1}$ and let $f: S \to H$ be a morphism. The f can be extended to a morphism of G into H in a unique way (1971).

In the usual definition of skew-field RADÓ has replaced the axioms of the existence of unit and inverses by a weaker requirement, which can be stated as follows: Let $(F, +, \cdot)$ be a distributive nearring, $F^* = F\backslash\{0\}$, $M = \cap \{xF \cup Fx \mid x \in F^*\}$ and $N = \{x \in F \mid 0 \notin xF^*\}$. Then, $(F, +, \cdot)$ is a skew-field if and only if $M \cap N \neq 0$.

W. Leissner has characterized by geometric axioms the plane geometry over a weakly 1-finite ring (i.e. a ring with 1 such that $ab = 1 \Rightarrow ba = 1$). RADÓ gave an extension to arbitrary rings with identity. The geometric axiom concerning the existence and unicity of the line incident with two non-neighbouring points A and B is now replaced by the requirement that the intersection of all lines incident with A and B be a line. Leissner's other axioms remain essentially the same (1980). Corresponding results for the multidimensional case were given by W. Leissner, R. Severin and K. Wolf.

In the last years great effort have been made to characterize isometries (and semi-isometries) of different metric spaces under weak assumptions. Remind two theorems: A. D. Alexandrov's (1950) and F. S. Beckman—D. A. Quarles' (1953). The first states that a *bijection* of the Minkowski spacetime M_t $(n \geqslant 3)$ into itself, which preserves the zero pseudo-euclidean distances in *both directions* is necessarily linear (up to translation). By the second, for given $r > 0$, *any* mapping f of the Euclidean space E_n $(n \geqslant 2)$ *into* itself such that $|PO| = r \Rightarrow |P^f O^f| = r$ must be a motion (i.e. linear up to translation). Unlike Beckman-Quarles theorem, that of Alexandrov does not hold in the two-dimensional case, but a bijective mapping $f: M_2 \to M_2$ which leaves invariant one pseudo-euclidean distance $r \neq 0$, in both directions, is a Lorentz transformation (i. e. linear up to translation), as was proved by W. Benz in 1977. RADÓ generalized this result going over from the real numbers to an arbitrary field K with char $K \neq 2$ or 3, i.e. he proved the result above for an Artinean plane (non singular, non-anisotropic metric vector plane over K) (1980). The main idea was to draw in the proof Hua's theorem concerning the characterization of field monomorphisms. Then W. Benz generalized further in the sense that f can be *any* mapping of the Artinean plan into itself preserving the distances 1 *in one direction;* then f must be semi-linear (up to translation), provided the field K satisfies one of a list of assumptions (taking 1 istead of $r \neq 0$ is really no restriction). The following important step was made by RADÓ in 1983 by reducing Benz's assumptions only to char $K \neq 2$, 3 or 5 or $K = GF(5^m)$, $m > 1$, Among RADO's other results in this area is worthwise to mention: Let V be a metric vector space over the field $GF(p^q)$, $p > 2$, $3 \leqslant \dim V = n < \infty$; given a mapping $f: V \to V$ such that $|PQ| = 1 \Rightarrow |P^f Q^f| = 1$, then f is semi-linear (up to translation), provided $n \not\equiv 0, -1, -2 \pmod p$ or the discriminant of V satisfies a certain condition. The proof is based on the condition for a regular simplex to exist in a Galois space, which is of interest for its own sake, as well.

He formulated in 1963 the ,,branch and bound'' method to solve the disjuntive programming problem, independently from the other authors who gave similar algorithms. In his review on RADÓ's paper (published in romanian), E. Balas writes in the International Abstracts in Operations Research 7, No. 1, 1967: ,,The basic principle of the branch and bound technique devised by Land and Doing for the integer programming problem and adapted by Little, Murty, Sweeney and Karel for solving the travaling salesman problem, is rediscovered here independently, stated in a more general form and used to solve a very important problem: linear programs with logical constrains. It is to be noted that this work precedes the important paper by P. Bertier and B. Roy on the S.E.P.".

An extension theorem for Pexider's equation, in a general setting is proved in a joint paper with J. A. Baker, which is then used to generalize aggregatoin theorems for allocation problems by Aczél, Ng and Wagner (1987).

Among the various problems of optimally locating a new service facility with respect to the locations of n existing facilities, the Steiner problem arises when one seeks to minimize the sum of the weighted distances from the new facility to the existing ones (if $n = 3$ and weights $= 1$, it is the 300 years old Fermat problem). E. Weiszfeld proposed an iterative algorithm for solving the Steiner problem, but not until the 1970's, however, did H. Kuhn and L. M. Ostresh demonstrate that this algorithm always solves the problem. In 1958 W. Miele proposed an extension of the Weifeld algorithm to the Euclidean multifacility location problem (with several new facilities). RADÓ has provided, in an arbitrary dimensional Euclidean space, for a slightly modified version of Miele's algorithm Kuhn-Ostresh type theorems for convergence and optimality, both under mild assumptions (1988).

PROF. F. RADO's PUBLICATIONS

A. Research papers

1. *Observații asupra unui sistem liniar infinit* (*Remarks on an infinite linear system;* romanian). Bull. șt. secț. șt. mat. fiz., 5 (1953), 285–292.
2. (With G. Călugăreanu) *Asupra unei probleme de propagare a căldurii* (*On a problem of heat propagation;* romanian). Bul. șt. secț. șt. mat. fiz., 6 (1954), 17–30.
3. (With L. Bal). *Două teoreme referitoare la separarea variabilelor în nomografie*. Comunic. Acad. R.P.R., 5 (1955), 285–290 (*Two theorems concerning the separation of va-iall-s in nomography*).
4. (With L. Bal) *Separarea variabilelor în nomografie* (*The separation of variables in nomography*). Comunic. Acad. R.P.R., 5 (1955), 303–305.
5. *Condiții de dependență liniară pertru trei funcții continue* (*Linear dependence conditions for three continuous functions*). Studii și cercet. Cluj, ser. I, 6 (1955), 51–63.
6. (With E. Gergely, L. Bal and G. Ionescu) *Despre nomogramele romboidale*. (*On rhomboidal nomograms*). Lucrările consf. de geometrie diferențială, Timișoara, 361–366 (1955).
7. *Certaines propriétés des intégrales des équations différentielles linéares.* Lucrările celui de al IV-lea Congres al matematicienilor români, 1956, 162–163.
8. *Az algebrai egyenletek numerikus megoldásáról* (*On the numerical solution of the algebraic equations;* hungarian). Bul. Univ. Babeş și Bolyai, ediția 1, maghiară, 2 (1957), 13–24.
9. *Cea mai bună transformare proiectivă a scărilor la nomograme cu puncte aliniate* (*The best projective transformation of the scales of alignment nomograms*). Studii și cercet. de matematică, Cluj, 8 (1957), 161–168.
10. *Despre contactele nomogramelor cu transparent* (*On the contacts of the nomograms with transparents*). Studii și cercet. de matem., Cluj, 8 (1957), 319–329.
11. *Ecuații funcționale în legătură cu nomografia* (*Functional ecuations in connection with nomography*). Studii și cercet. de matematică Cluj, 9 (1958), 249–320.
12. *Équations fonctionelles caractérisant les nomogrammes avec trois échelles rectilignes*. Mathematica, 1 (24), fasc. 1 (1959), 143–166.
13. *Sur quelques équations fonctionnelles avec plusieurs fonctions a deux variables*, ibid, 1 (24), fasc. 2. (1959) 321–339.
14. (With J. Aczél and G. Pickert) *Nomogramme, Gewebe und Quasigruppen*. Mathematica, 2 (25), (1960), 5–24.
15. *Despre problema programării liniare* (*On the problem of linear programming*). Studii și cercet. de mat. Cluj, Fasc. anexă, 11 (1960), 167–177.
16. (With E. Munteanu) *Calculul șarjelor celor mai economice la cuptoarele de topit fontă* (*The calculation of the most economic cha ges of the furnaces to melt cast iron*). Studii și cercet. de mat. Cluj, Fasc. anexă, 11 (1960), 149–158.

17. *Generalizarea țesuturilor spațiale pentru structuri algebrice* (*Generalization of spatial webs related to algebraic structures*). Studia Univ. Babeș-Bolyai, 1960, ser. I, fasc. 1, 41–55.
18. *Eine Bedingung für die Regularität der Gewebe.* Mathematica, 2 (25) (1960), 325–334.
19. *Le calcul aproximatif des extrèmes des fonctions.* Mathematica, 3 (26), (1961), 171–177.
20. *Caractérisation de l'ensemble des intégrales des équations différentielles linéaires homogènes a coefficients constantes d'ordre donné.* Mathematica 4 (27), (1962), 131–143.
21. *Characteristica spojnicovych nomogramu rodu nula funcnimi rovnicemi* (*The characterization of alignment nomograms of genus zero by functional equations*) (czech language). Nomografické Metody, Praha, 1962, 86–91.
22. *Nomograme, țesuturi și cuasigrupuri* (*Nomograms, webs and quasigroups*). Studii și cercet. de mat., fasc. anexă 13 (1962) 305–319.
23. (With L. Németi) *Ein Wartezeitproblem in der Produktion.* Mathematica 5 (28) (1963), 65–95.
24. *Programare liniară cu condiții logice* (*Linear programming with logical conditions*). Comunicările Acad. R.P.R., 13, nr. 12 (1963), 1039–1042.
25. *Un algorithme pour résoudre certains problèmes de programmation mathématique.* Mathematica 6 (29) (1964), 105–116.
26. *Țesuturi ternare regulate* (*Regular ternary webs*). Studia Univ. Babeș-Bolyai, ser. 1, fasc. 1, 1964, 39–60.
27. (With M. Hosszú) *Über die Klasse von ternären Quasigruppen.* Acta math. Acad. sci. Hung., 15 (1964), 29–36.
28. (With V. Groze and B. Orbán) *Propriétés extrémales dans une classe de fonctions et application à la transformation des nomogrammes.* Mathematica 6 (29), (1964), 307–326.
29. *Einbettung eines Halbgewebes in ein reguläres Gewebe und eines Halbgruppoids in eine Gruppe.* Mathem. Zeitschrift, 89 (1965), 395–410.
30. *Über die beste projektive Transformation der genadlinigen Leiter.* Zeitschr. f. angewandte Mathematik und Mechanik, 45 (1965), 356–359.
31. (With L. Németi) *Sur la programmation temporelle de la fabrication.* Mathematica, 8 (31) (1966), 109–115).
32. (With V. Peteanu) *Structures algébriques rattachées aux problemes d'ordonnancement.* Lucrările colocv. de teoria aproximativă a funcțiilor, Cluj, 1967, 1–35.
33. *Sur le problème de flôt à cout minimum.* Studia Univ. Babeș-Bolyai, ser. Math. Phys., fasc. 1, 1968, 67–79.
34. (With V. Groze) *Determinarea transformărilor optime ale nomogramelor cu puncte aliniate.* (*The determination of the optimal transformations of alignment nomograms*). Studia Univ. Babeș-Bolyai, ser. Math. Phys., fasc. 2, 1969, 9–14.
35. *Einbettung von Inzidenzstrukturen in projektive Ebenen mit vorgegebenen Schliessungssätzen.* Archiv der Mathematik, 20 (1969), 311–319.
36. *Darstellung nicht bijektiver Kollineationen eines projektiven Raumes durch verallgemeinerte semilineare Abbildungen.* Math. Zeitschr., 110 (1969), 153–170.
37. *Non-Injective Collineations on Some Sets in Desarguesian Projective Planes and Extension of Non-Commutative Valuations.* Aequationes Math. 4 (1970), 307–321.
38. *Congruence Preserving Isomoprhisms of the Translation Group Associated with a Translation Plane.* Canad. Journal of Math., 23 (1971), 214–221.
39. *A Branch and Cut Method for Solving Mixed One-Zero Programs.* Publ. de l'Univ. de Montréal, Fac. de Sciences, 22 (1970), 1–18.
40. (With J. Aczél. J. A. Baker, D. Z. Djocović, P. L. Kannappan) *Extensions of Certain Homomorphisms of Semigroups to Homomorphisms of Groups.* Aequat. Math., 6 (1971), 263–271.
41. *Extension of Collineation Defined on Subsets of a Translation Plane.* Journal of Geom., 1 (1971), 1–17.
42. *On Semi-Symetric Quasigroups.* Aequationes Math., 11 (1974), 250–255.
43. *Über die Bewertung der Vektorräume. Remark to the Problem of H. Hadwiger.* Reports of Meetings. Aequationes Math. 11 (1974), 299 and 309.
44. (With J. Aczél) *Involutory Functions Induced by Abelian Groups.* Studia Univ. Babeș-Bolyai, ser. Math. Mech., 1974, 32–40.
45. *A Generalization of Valued Vector Spaces. Applications to Homomorphisms of Projective Spaces and to Hjelmslev Geometries.* Preprint, Cluj-Napoca, 1975, 29 pages.
46. *Remark on a Functional Equation.* Aequationes Math., 14 (1976), 228–230.
47. (With R. Miron) *On the Definition of a Module and a Vector Space by independent Axioms.* Mathematica, 18 (41) (1976), 179–186).

48. (With B. Orbán) *Nomograms with Minimal Global Error.* L'analyse numérique et la théorie de l'approximation, 6 (1977), 163–170.
49. *A generalization of the valued vector space*, Mathematica, 19 (42), (1977), 203–209.
50. *Affine Geometries and Affine Barbilian Structures.* Lucrările Col. Geom. şi top., 22–24 sept. 1978, Cluj-Napoca, 27–45.
51. *On the Definition of Skew Fields.* Archiv der Mathematik, 32 (1979), 441–444.
52. *On the Characterization of Affine Isometries.* Resultate der Mathematik, 2 (1979), 171–185.
53. *On the Characterization of Plane Affine Isometries.* Resultate der Math., 3 (1980), 70–73.
54. *Affine Barbilian Structures.* Journ. of Geom., 14 (1980), 75–102.
55. *Plane afine Barbilian (Affine Barbilian Planes).* Lucrările colocv. naţ. de geom. şi top., Vaslui –Valea Hogei–Bacău, 27–30 iunie 1980, 87–94.
56. *Pre-Euclidean Planes over Pythagorean Fields and Orderable Fields.* Lucrările colocv. naţ. de geom. şi top., Bucureşti, 27–30 iunie 1981, Bucureşti, 1983, 316–322.
57. *A Characterization of the Semi-Isometries of a Minkowski Plane over a Field K.* Journ. of Geom., 21 (1983), 164–183.
58. (With C. Tarţia) *A Characterization of the Isometries of the Rational Minkowski Plane.* Mathematica, 26 (1984), 183–187.
59. *Teoreme de tip Beckman-Quarles în plane Minkowski generalizate peste un cîmp. (Beckman-Quarles Type Theorems in Generalized Minkowski Planes over Fields).* Lucrările colocv. naţ. de geom. şi top., Piatra Neamţ, iunie 1983, Iaşi 1984, 15–24.
60. *On the Characterization of the Semi-Isometries of a Galois Space.* Lucrările colocv. naţ. de geom. şi top., Timişoara, 2–7 iulie 1984, 237–240.
61. *Mappings of the Galois Planes Preserving the Unit Euclidean Distance.* Aequationes math., 29 (1985), 1–6.
62. (With I. Muntean) *Un model al geometriei din manualul pentru clasa a IX-a.* Lucrările seminarului de ,,Didactica Matematicii", Cluj-Napoca, 1985, 67–82 *(A model for the geometry presented in the textbook for grade IX).*
63. *On mappings of the Galois space.* Israel Journal of Math., 53 (1986), 217–230.
64. *On the Combinatorial Types of Polytopes over an Ordered Skew Field.* Research Seminars, Faculty of Mathematics, Cluj-Napoca, no. 10 (1986), 3–8.
65. (With D. Andreescu and D. Vâlcan) *Mappings of E^n into E^n Preserving two Distances.* Research Seminars, Faculty of Math. Cluj-Napoca, no. 10 (1986), 9–22.
66. *On the Semi-Isometries of Metric Vector Spaces.* Lucrările colocv. naţ. de geom. şi top Tîrgovişte, 12–14 aprilie 1986; Bucureşti, 1988, 239–244.
67. (With J. A. Baker) *Pexider's Equation and Aggregation of Allocations.* Aequationes Math., 32 (1987), 227–239.
68. *On the Euclidian Multifacility Location Problem.* Operations Res., 36 No. 3, (1988), 485–492.

B. **Lecture Notes, Textbooks, Books**

1. *Analitikus mértan (Analytic Geometry)* (hungarian), Lithographed, Cluj, Ed. 1, 1954, Ed. 2, 1958.
2. (With L. Bal) *Lecţii de nomografie (Lectures in nomography)*, Ed. Tehnică, Bucureşti, 1956.
3. (With V. Cseke and E. Kiss) *Feladatgyűjtemény középiskolai matematikai körök számára) (Exercise book for mathematical circles in secondary school).* Ed. Tehnică, Bucureşti, vol. 1, 1957; vol. 2, 1959.
4. (With P. Szilágyi) *Analitikus mértan példatár (Exercise Book for Analytical Geometry)*, Lithographed, Cluj, 1958.
5. *Curs de geometrie (A Course in Geometry)*, Univ. Babeş-Bolyai, Cluj, 1972.
6. *Lecţii de programare liniară (Lectures in Linear Programming).* Univ. Babeş-Bolyai, Cluj-Napoca, 1975.
7. (With G. Galbură) *Geometrie (Geometry).* Ed. Didactică şi Pedagogică, Bucureşti, 1979.
8. (With B. Orbán, V. Groze and A. Vasiu) *Culegere de probleme de geometrie (Exercise Book for Geometry).* Univ. Babeş-Bolyai, 1979.
9. (With B. Orbán) *A geometria mai szemmel (Geometry under modern view point)*, Ed. Dacia, Cluj-Napoca, 1981.
10. *Sistemul axiomatic al lui Bachmann (Bachmann's Axiomatic System).* Chapter IX of the book ,,The Foundations of Arithmetic and Geometry" by R. Miron and D. Brînzei). Ed. Academiei R.S.R., Bucureşti, 1983, 218–233.

11. *Matematikai kislexikon (Little Mathematical Enciclopaedia;* (hungarian) in common with Gy. Maurer, B. Orbán, P. Szilágyi and M. Vincze, Ed. Kriterion, Cluj-Napoca, 1983.
12. *Geometria pentru perfecţionarea profesorilor (Geometry to improve the teachers' knowledge)* in common with A. C. Albu, V. Obădeanu, I. P. Popescu and D. Smaranda; editors R. Miron and D. I. Papuc. Ed. Didactică şi Pedagogică, Bucureşti, 1983.

C. **Informing Writings**

1. *A Bolyai Emlékkönyv matematikai vonatkozásai (The Mathematical Aspects of the Bolyai Remembrance Book;* hungarian). Utunk, X. évf., 5 sz., 1954 jan. 29.
2. *Algebrai és geometriai struktúrák kapcsolata (Connenctions between Algebraic and Geometrical Structures;* hungarian), Korunk 1973-as Evkönyve, 257–271.
3. *Vektorterek (Vector Spaces;* hungarian). Matematikai Lapok, 1977, No. 10, 370–378.
4. *Geometria absolută (Absolute Geometry;* romanian), Lucrările Şimp. Bolyai János, organizat cu prilejul împlinirii a 175 de ani de la naştere, Cluj-Napoca, 15.12.1977. Facultatea de Matematică, Cluj-Napoca, 1979, 99–111.
5. *Cîteva momente din istoria geometriei (Some moments from Hystory of Geometry;* romanian). Lucrările Seminarului de ,,Didactica Matematicii, 4, Cluj-Napoca, 1988, 213–230.

D. **Papers on Prof. F. RADÓ**

V. Groze, M. Ţarină, A. Vasiu — *The Life and Work of Professor F. RADÓ*, Research Seminars, Seminar on Geometry, Faculty of Mathematics, "Babeş-Bolyai" University Cluj-Napoca, Preprint Nr. 2, 1991.