

## Curriculum VITAE

<b>Surname</b>	<b>BURDUJAN</b>
<b>First name</b>	<b>ILIE</b>
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<b>Education</b>	Graduate "Al. I. Cuza" University, Iași, Faculty of Mathematics and Mechanics Ph. D. in Mathematics from the University of Iasi in 1977
<b>Position</b>	Professor, faculty of Horticulture, University of Agronomical Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iași
<b>Scientific activity</b>	3 textbooks (rotaprint UT Iași) 7 books (in several publishing houses) 89 scientific papers published both in national or international journals 23 scientific papers published in volums of Conferences and Symposiums from our country or abroad
<b>Grants</b>	- 25 grants (ME, ICEMAT, IFTAR, ICPE-CNST)
<b>Member of professional/scientific organizations/organisms</b>	- Romanian Society of Mathematical Sciences, - ROMAI- Romanian Society of Applied and Industriale Mathematics, - Biophysical Romanian Society, - Balkan Society of Geometers, - American Mathematical Society.
<b>Reviewer</b>	- Zentralblatt für Mathematik - Mathematical reviews
<b>Foreign languages</b>	- English
<b>Competences</b>	- Differential Geometry, - Nonassociative algebraic structures, - Quadratic dynamical systems, - Plasma Physics, - Mathematical Statistics.
<b>Fields of scientific interest</b>	- Plasma Physics, - Differential Geometry, - Nonassociative algebras, - Quadratic dynamical systems applied in biology,
<b>Other activities</b>	- editor in chief: Proceedings of the annual Symposium on Mathematics Applied in Biology&Biophysics - member of the Scientific Committee: Annual Symposium on Mathematics Applied in Biology&Biophysics, fac.Hort. UASMV Iasi (2002-2006), ROMAI Conference 2005, 2006, 2007, 2009, DGDA 2009 - chairman: CAIM 2005, Int. Conf. ASADE Chisinau 2007, DGDA 2006, CAIM 2009 - member of the jury of Ph. D. (UAIC Iasi, University of Pitesti, Chisinau) - invited to deliver lectures on advanced topics in Differential Geometry and Plasma Physics at Abdus Salam School of Math. Sciences, GC University Lahore, Pakistan in 2008 and 2009
<b>Family situation</b>	- Married, two children

## Teaching Activity

Seminaries: Analytical Geometry (“Al. I. Cuza” University Iași, i.e., UAIC), Linear Algebra and Analytical Geometry, Calculus, Special Topics in Mathematics and Numerical Methods (Technical University Iași-i.e., TU), General Mathematics and Biological Statistics (University of Agronomical Sciences and Veterinary Medicine “Ion Ionescu de la Brad” Iași, i.e., USAMV).

I have taught courses (and the corresponding seminars) on: Linear Algebra and Analytical Geometry, Calculus, Special Topics in Mathematics, General Mathematics and Numerical Methods (TU Iași), Nonassociative Algebras (V, IV Math. Fac. UAIC) and Associative Algebras (IV, Math. Fac. UAIC); I gave also lessons in Mathematics for economists (Economic Faculty of UAIC). Moreover, I gave lessons on Mathematical Statistics for master training. Now I give lessons on Applied Mathematics and Mathematics and Biological Statistics (USAMV).

## Doctoral studies

I got my Ph. D. in 1977 with a thesis in differential geometry entitled “**Continuous and Lie quasigroups and loops and applications in differential geometry**” (supervised by Prof. dr. doc. Gheorghe Gheorghiev, „Al. I. Cuza University”, Iași).

## Scientific activity

I studied several problems in **plasma physics, namely**

- the diffraction of fast magneto-acoustic waves by a plasma layer of a periodically varying density ([1], [2]),
- the interaction of an alternating electrical field with a magnetized totally ionized plasma ([11]),
- wave-wave interaction in a plasma in the presence of a strong magnetic field ([21]),
- the interaction of an alternating electrical field with an inhomogeneous magnetized plasma ([11], [24], [90]),
- the general form of the electron distribution function for an inhomogeneous magnetized fully ionized plasma interacting with an alternating electrical field ([24]),
- double layer formation and micro-instabilities in the implosion phase of a plasma focus discharge ([25])
- the dispersion relation for the instabilities in a plasma ([103]).

Another research direction is connected with the study of **relativistic magneto-hydro-dynamics** (MHD) in the scalar-tensor theories of gravitation ([94]) and the study of a MHD-gravitational resonator ([12]).

In the **differential geometry of Lie loops I obtained the results:**

- a local characterization for the finite dimensional analytical and Lie loops by means of the so-called basic fields and of the structural operator; these objects allow to characterize the local homomorphism and isomorphisms of loops, the sub loops and normal divisors, integrable loops, non-integrable and non-semisimple loops (see [3]),
- a local characterization of the Lie loops by means of the tangent algebra (in the meaning of Mal'tsev-Pontriagin-Lie) and by the structural field of operators [7],
- generalize these results for the Lie-Banach loops [4]
- the construction of the so-called semi-direct product of a quasigroup or loop with a compatible group [6],
- some particular answers for the so-called „Hilbert’s fifth problem” for quasigroups such as:
  - a) for a topological locally compact loop, the group generated by the left multiplications endowed with c.o.-topology, g-topology, or l.i.s.g.-topology is locally compact if and only if it is a Baire space [8]
  - b) for any finite dimensional, locally compact and locally connex topological quasigroup satisfying either the postulat A or the postulat B of Sushkevici the group generated by the left/right multiplications endowed with c.o.-topology is a Lie group of transformations acting effectively and transitively on the quasigroup space [8].

In the **non-associative algebras I obtained the results:**

- the semigroup generated by left multiplications of a non-associative algebra having a finite number of singular directions is a Lie semigroup [100],
- a construction of a covariant functor from the category of non-associative algebras to the category of homogeneous systems (in Yamaguti’s meaning); the restriction of this functor to the subcategory of associative algebra becomes the well known functor assuring the passing from an associative algebra to a Lie algebra [5],
- any anticommutative algebra can be identified with a vector subspace of a Lie algebra complementary to a Lie subalgebra,
- the tangent space at unity of a Lie loop is a homogeneous system (in the Yamaguti’s meaning); actually, a covariant functor from the category of Lie loops to the category of homogeneous systems (of Yamaguti) is constructed [13],

- I proved the analog of *Campbell-Hausdorff-Baker formula for homogeneous systems* what allows to give a functorial construction from the category of homogeneous systems to the category of monoassociative Lie loops [15].
- a structure theory for a class of commutative algebras satisfying an identity of degree four and their applications in Lie triple system theory are given.

#### Studies on the **homogeneous systems** (of Yamaguti):

- the class of special homogeneous systems (which contains the Lie triple systems as well as the general Lie triple systems) was especially analyzed in [14],
- a realization of the Lie algebra associated with each special homogeneous system as a Lie algebra of polynomial vector fields on the ground space of the homogeneous system is defined [65],
- the cohomology groups associated with a representation of a special homogeneous system are defined and the corresponding interpretations for the first three cohomology groups are given [86], [89].
- a classification, up to an isomorphism, of the real 2-dimensional division algebra was achieved [22],
- *any 2-dimensional linear Lie quasigroup is a homogeneous space in the Cartan's meaning* [30],
- for any unitary algebra A, the Lie algebra generated by its left multiplications is coincident with the Lie algebra naturally associated with the homogeneous system of A,
- an upper bound on the dimensions of the Lie subalgebras of derivations which commute with each other was obtained [36] for any algebra without nilpotents of order two,
- any non-associative algebra can be embedded into an associative algebra as a vector subspace which is complement for a subalgebra [37],
- a numerable family of deviations from associativity was identified [33].

#### In **Differential geometry**

- I introduced the manifolds of Clifford type ([39], [55]) and I have obtained the class of all almost Clifford connections on such manifolds,
- I studied the Kähler-Clifford manifolds [84].

#### In **Quadratic Dynamical systems** theory:

- I proved that there exists an 1-1 correspondence between the classes of center-affinely homogeneous quadratic systems and the classes of isomorphic commutative algebras [51],
- by using the functorial construction from [5] I proved that for certain (1,2)-tensor fields on a manifold a Lie algebras fiber on the given manifold is associated [38],
- I studied the so-called binary-ternary algebras,
- the results are applied in the study of well-known Lotka-Volterra models in ecology, SIR-like models in epidemiology and in the mathematical models for infectious diseases [54], [60], [62], [64], [69], [70], [75-77], [86].

#### **Fluid Mechanics**

- I solved some problems for the so called „generalized” Oldroyd-B fluids.

### **Papers (Selected list)**

1. D. Zoler, **I. Burdujan**, 1973, *Дифракция быстрых магнитозвуковых волн на слое плазмы возмущенной проходящей волной*, Магнитная гидро-динамика, 3, p.47-52.
2. D. Zoler, **I. Burdujan**, 1973, *The diffraction of fast magnetoacoustic waves by a plasma layer of a periodically varying density*, Physica, T.63, p.163-171.
3. **I. Burdujan**, 1974, *On the Lie algebra of vector fields of a Lie loop*, (in Romanian) Ann. Univ. Iași, T.XX, seria 5, mat., p.107-121, **Zbl. 376.22015, MR 50#4812.**
4. **I. Burdujan**, 1976, *Sur les Boucles de Lie-Banach*, Proc. of the Inst. of Math, Iași, Ed. Acad. R.S.R., p.23-30, **Zbl. 377-58004, MR 56#6698, RJ Mat. 9A855.**
5. **I. Burdujan**, 1976, *Sur un Théorème de K. Yamaguti*, Proc. of the Inst. of Math, Iași, Ed. Acad. R.S.R., p.31-35, **Zbl. 368-17004, MR 57#9734, RJ Mat. 8A330.**
6. **I. Burdujan**, 1976, *Некоторые замечания о геометрии квазигрупп*, Mat. Issled, T.39, p.40-53, **Zbl.431.22018, MR 55#8235.**
7. **I. Burdujan**, 1977, *Одно из свойств структурных оператор левых луп*, Publ. Inst. Polyt. Iași, T.XXIII, p.33-38, **Zbl. 37720055, MR 58#11253.**
8. **I. Burdujan**, 1978, *Groupes de transformations dans la théorie des quasi-groupes topologiques*, Ann. Sci. Univ. Iași, seria 5, T.XXIV, p.31-38, **Zbl. 412.22002, MR 80c:22004.**
11. **I. Burdujan**, D. Zoler, 1980, *On the interaction of an alternating electrical field with a magnetized fully ionized plasma*, Beiträge aus der Plasmaphysik, T. 20, n.6, p.385-402.
12. C. Ciubotariu, D.Zoler, **I. Burdujan**, 1980, *The M.H.D.-Gravitational Resonator*, Contributed Papers, 9<sup>th</sup> International Conference on General Relativity and Gravitation, Jena, 376-378.

13. A. Corciovei, R. Grimberg, **I. Burdujan**, 1982- *Spin motions in a linear Heisenberg system*, Rev. Roum. de Physique, T.27, p. 183-189.
14. **I. Burdujan**, 1981, *Grupul infinitesimal asociat unui sistem omogen special*, Lucr. Ses. jubiliare, I.P.Iași, p.16-21, **Zbl. 622-17013 (1988)**.
15. **I. Burdujan**, 1981 *O formulă de tip Campbell-Hausdorff pentru sisteme omogene în sens K. Yamaguti*, Lucr. Ses. jubiliare, I.P. Iași, p.22-25, **Zbl. 622-17014 (1988)**.
21. D. Zoler, **I. Burdujan**, C.Ciubotariu, 1984, *Wave-wave interaction in a CGL-plasma*, Doklady Boljgarskoj Akademij Nauk, T.37 n.2, 153-157.
22. **I. Burdujan**, 1985, *Types of non-isomorphic two-dimensional real division algebras*, Ann. St. Univ. Iași, T.XXXI, (supl.), p. 102-105, **Zbl.606.17001, MR 88b:17003**.
24. D. Zoler, **I. Burdujan**, 1986, *On the interaction of an Alternating Electrical Field with an Inhomogeneous Magnetized Plasma*, Contrib. Plasma Phys., T.26, n.2, p.129-141.
25. C. Ciubotaru, I.Grosu, V. Stancu, **I. Burdujan**, 1988 -*Double Layer Formation and Microinstabilities in the Implosion Phase of a Plasma Focus Discharge*, Ann. Sci. Univ. Iași, T.34, supl.,193-197 (Proc. of the third Symposium on Plasma Double Layers, Bucharest, 1988).
30. **I. Burdujan**, 1993, - *The Linear Quasigroup Associated to a Two-dimension Real Division Algebra in a Homogeneous Space*, Bul. IPI XXXIX(XLIII).f.1-4, p.1-16, **Zbl. 835-17003 , MR 1 491 178**.
33. **I. Burdujan**, 1994 - *On Homogeneous System Associated to a Binary Algebra*, Ann. Univ Ovidius, v.2. p.31-38, **Zbl. 884-17001, MR 96j:00017, MR 1 367 542**.
35. **I. Burdujan**, 1996,- *On Derivation of Some Commutative Algebras*, Mem.St. ale Academiei Române, T. XIX, p.213-216, **MR 2000d: 13034**.
36. **I. Burdujan**, 1999, - *On Derivation Algebra of a Real Algebra without nilpotents of order two*, Italian Journal of Pure and Applied Mathematics, v.7, p. 137-154, **MR 1793751(2001j:17005)**.
37. **I. Burdujan**, 2000, - *Embeddings of Nonassociative Algebras*, Italian Journal of Pure and Applied Mathematics, v.8, p. 85-94, **Zbl. 992.23254, MR 1784550 (2001g: 17002)**.
38. **I. Burdujan**, 2000,- *An example of a Lie algebra vector bundle*, Studii și Cercetări științifice, Univ. Bacău, v.10 p. 71-84. **MR 1886283(2003a:58004)**.
39. **I. Burdujan**, 2000, - *On almost Cliffordian manifolds*, Studii și Cercetări științifice, Univ. Bacău, v.10 p. 85-97. **MR 1886284(2003a:53033)**.
42. **I. Burdujan 2001**- *On minimal lightlike Monge hypersurfaces in a Lorentz space* Ann. Sci Univ. "Al. I. Cuza" Iași T.XLVII, 95-103. **MR 1920194 (2003f:53031)**.
51. **I. Burdujan, 2002** - *Quadratic dynamical Systems in Ecology*, Ann. USAMV Iași, T. XLV, Hort., (Proc. Ann. Symposium "Mathematics applied in Biology &Biophysics", U:S.A.M.V.-Iași) pp. 7-22. **Zbl. 1053.92041, MR 2149789**.
52. **I. Burdujan, 2002** - *On Clifford-like structure*, Bull. Math. Soc. Math. Roumanie, Tome 45(93), no.3-4, 2002, 145-170. **MR 2098686 (2005g: 53040)**.
54. **I. Burdujan, 2003** - *Dynamical systems as epidemic models*, Ann. USAMV Iași, T. XLVI, Hort., Proc. Ann. Symposium "Mathematics applied in Biology &Biophysics", U:S.A.M.V.-Iași, pp.63-86. **MR 2149034 (2006g: 37140)**.
55. **I. Burdujan 2003** - *On almost Cliffordian manifolds*, Italian Journal of Pure and Applied Mathematics, v.13, pp.129-144. **MR 2074143 (2005c: 53029)**.
60. **I. Burdujan 2004** - *Dynamics of Microparasitic Infections*, Ann. U.S.A.M.V. Iași, v.2(47), seria Hort. Proc. Ann. Symposium "Mathematics applied in Biology &Biophysics", U:S.A.M.V.-Iași, p. 107-118. **MR 2148105 (2006j: 34118)**.
62. **I. Burdujan 2005** - *On the dynamics of microparasitic infections*, Ann. Sci. Univ Iași Sect. Biofizică, Fizică medicală, Fizica mediului (Conferința Națională a societății de Biofizică – Iași 2005). V. 1, p. 47-50.
64. **I. Burdujan 2005** - *On a Criss-cross Model for the Dynamics of Infectious Diseases*, Ann. of USAMV Iași, Hort.,tom 48, v.2, seria Hort. Proc. Ann. Symposium "Mathematics applied in Biology &Biophysics", U:A.S.V.M.-Iași, p.85-94.
65. **I. Burdujan 2005** - *Infinitesimal Groups associated with a Quadratic Dynamical System*, ROMAI Journal. v.I, no.1, p. 37-42.
66. **I. Burdujan 2005** - *Some new properties of Lie Triple Systems*, ROMAI Journal. v. 2, no.1, p. 7-23.
67. **I. Burdujan 2005** - *A universal enveloping algebra for a Lie triple system*, Proceedings of the 3-rd International Colloquium of Mathematics in engineering and numerical Physics (MENP-3), October 7-9, 2004, pp. 59-71. (aparut in BSG Proceedings 12 \* Geometry Balkan Press 2005).
68. **I. Burdujan 2006** - *About a criss-cross model for bovine tuberculosis*, Sci. Papers, UASVM Iasi, Sect. Zoot., v. XLIX, p. 130-135, ISSN 1454-7368.
69. **I. Burdujan 2006** - *Dynamics of viral diseases*, Sci. Papers, UASVM Iasi, Sect. Zoot., v. XLIX, p. 124-129, ISSN 1454-7368.
70. **I. Burdujan 2006** - *On a criss-cross-like model for the dynamics of infectious diseases*, Sci. Papers, UASVM Iasi, Sect. Horticulture, v. XLIX (2), ISSN 1454-7376.
72. **I. Burdujan 2006** - *New Results on Homogeneous Systems*, Proc. MENPH4, 2006, p. 53.62, Ed Balkan Press, București.

- 75. I. Burdujan 2007** – *About a competition-colonisation model*, Sci. Papers, UASVM Iasi, Sect. Hort., Anul L, Vol 1, (50), 77-82.
- 76. I. Burdujan 2007** – *Populations in competition*, Sci. Papers, UASVM Iasi, Sect. Hort., Anul L, Vol 1, (50), 83-88.
- 77. I. Burdujan 2007** – *Mathematical Models in Epidemiology*, Sci. Papers, Sect. Zoot., Anul L, Vol 1, (50), 83-90.
- 84. I. Burdujan 2007** – *Cubic dynamical systems and ternary algebras*, Libertas Matematica, v. XXVII, p. 37-55.
- 85. I. Burdujan 2007** – *Clifford Algebra  $\mathbf{X}\mathbf{A}_{03}$* , Bul. I.P.I., T. LIII, f.5, Sect. Matematica, Mecanica teoretica, Fizica, p. 35-49.
- 85. I. Burdujan 2007** – *Manifolds endowed with several complex structures*, Ann. Sci. Univ. "Al. I. Cuza" Iași (supl.) T.LIII, Sect.I, Matematica, p. 99-106.
- 86. I. Burdujan 2008** – *n-Homogeneous dynamical systems and n-ary algebras*, Bull. Acad. St. Rep. Moldova, Matematica, No. 2(54), 2008, p. 1-15.
- 89. I. Burdujan 2008** – *A Group of Involutions Characterising a Clifford Algebra of Type  $\mathbf{X}\mathbf{A}_{03}$* , Advances in Applied Clifford Algebras, 18 (2008), 1-8.
- 90. I. Burdujan 2008** – *Clifford-Kähler manifolds*, BJGA (Balkan Journal of Geometry and Its Applications) v.13, No. 2, p.12-23.
- 91. I. Burdujan 2008** – *Lotka-Volterra model for two-species in competition*, Sci. Papers, UASVM Iasi, Sect. Zoot., Anul LI, Vol 1, (51), 34-41.