



PERSONAGE IN SCIENCE

Professor Constantin Corduneanu

to the 84th Birthday Anniversary

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The paper contains the biographical sketch and reviews scientific achievements of Constantin Corduneanu, the outstanding researcher in Oscillations, Stability and Control Theory of the 20th century.

1 Brief Outline of C. Corduneanu's Life

Constantin Corduneanu was born on July 26th, 1928, in the City of Iasi, Province of Moldova, Romania, from the parents Costache and Aglaia Corduneanu. At that time, his parents were teachers in the village of Potangeni, Movileni commune in the District of Iasi.

At the age of 12, in 1940, he had to move to the City of Iasi for getting his secondary education. He decided to participate in the fierce competition for a place at the Military Lyceum of Iasi, and he was admitted there, as the 10th, from a number of 400 competitors. Four years later, in 1944, when the capacity exam had to be taken for promotion to the second stage of the secondary education, he was classified the 1st among his peers, with special mention for good answers in Mathematics. In 1945 he was transferred from office to the Nicolae Filipescu National Military College in Predeal (in the Carpathian Mts). There he finished his secondary education in 1947.

C. Corduneanu participated in what is nowadays called "Mathematical Olympiad", in the years 1946 and 1947, winning a prize in each case, the first in 1947. That success convinced him to become a mathematician, and in the Fall of 1947 he registered as a student at the Faculty of Science, Division Mathematics, with the University of Iasi.

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His association with the University of Iasi had lasted until the year 1977, period in which he held positions of Assistant, Lecturer, Associate Professor, Professor, Dean of Mathematics, Vice-Rector for Research and Graduate Studies, as well as some research positions with the Mathematical Institute of the Romanian Academy. C. Corduneanu also served, on different occasions, at the Iasi Polytechnic Institute and for three years at the newly created institution which is known today as the University of Suceava (where he also served as Rector during the period 1966–1967).

In 1977, C. Corduneanu decided to expatriate from Romania, and to reside in the United States of America. In January 1978, after teaching some courses at the International Centre for Theoretical Physics (UNESCO) in Trieste, Italy, he came from Italy to the USA, teaching the Spring Semester of 1978 at the University of Rhode Island, which he had visited before for two academic years and where he was familiar with the place and colleagues. Next academic year, 1978–1979, he was a Visiting Professor at the University of Tennessee in Knoxville. Meantime, the University of Texas at Arlington created a new professorial position, which C. Corduneanu occupied by competition in the Fall of 1979. Ever since, he has been associated with this school, currently holding the title of Emeritus Professor of Mathematics (retired in September 1996, after 47 years in higher education in Romania and the USA).

Besides his usual duties as a Professor, C. Corduneanu had many other activities, such as participating in various national or international conferences (more than 100), paying short visits and talking about his research work in over 60 universities or institutes, in all continents with the exception of Australia, and in over 20 countries (including Russia, Ukraine, Germany, England, France, Italy, China, Japan, Hungary, Poland, Portugal and Chile). He has published during the last 60 years about 200 research papers, including 6 books in a total of 15 editions (Romanian Academy, Academic Press in NY, Springer Verlag, Cambridge University Press, the Taylor and Francis Publishing House in London, John Wiley & Sons in NY, Allyn & Bacon in Boston). He has organized and participated in several conferences, in Romania and in the USA, including the Centennial Volterra Conference on Integral Equations and Applications, 1996, at the University of Texas at Arlington, attended by specialists from many countries.

During the last 45 years, he has been associated with at least 10 mathematical journals from Romania, the USA, South Korea, Israel and Ukraine.

2 Basic Trends of His Scientific Work

2.1 Global Problems in the Theory of Ordinary Differential Equations

This type of problems kept his attention at the beginning of his career, including the doctoral thesis defended in 1956 at the University of Iasi, the committee being composed by Academicians Miron Nicolescu, at that time president of the Romanian Academy, Grigore Moisil and Nicolae Teodorescu from Bucharest, a former student of J. Hadamard at Sorbonne. C. Corduneanu continued research work in this field for several years, studying global existence, stability problems, oscillation theory, with special regard to the almost periodic behavior of solutions to various classes of nonlinear equations.

2.2 Qualitative Theory of Differential Equations, with Special Regard to Stability Theory

The work in this category is mainly directed to ordinary differential equations and equations with causal operators. In [11], he has made one of the first steps in applying the so-called comparison method, and proving in a single theorem all basic results on Liapunov stability, based on using simultaneously the Chaplyguine-Wazewski approach to differential inequalities, and the Liapunov's function in general form. This method has been widely applied by the School of Academician V.M. Matrosov, Russia; and in Ukraine by Academician A.A. Martynyuk and his followers. The result published in [11], has been included in several monographs and treatises, by authors like V. Lakshmikantham and S. Leela, W. Hahn, T. Yoshizawa, A. Halanay, G. Sansone and R. Conti and others.

2.3 Theory of Integral Equations

In this domain he has contributed to generalizing the method due to Massera and Schaffer, from differential equations to integral equations. The book [J] contains the basic results he had obtained until 1987, which became one of most often quoted references in the literature. Also, the book [E] contains qualitative results with application to the stability of systems of automatic control.

2.4 Equations with Causal Operators

This category is aimed at presenting, as much as possible, a unified theory of equations with causal operators (according to Volterra–Tonelli–Tychonoff), that can cover the classical types of ordinary differential equations, equations with delay, integrodifferential equations with Volterra type integral, some discrete equations of evolution. In this regard he has published the book [K] covering research conducted by his group of students, as well as his own or joint projects (Mehran Mahdavi from Tehran and Yizeng Li from Shanghai). A second volume dedicated to this type of equations and their connection with the classical types of equations is now in preparation.

2.5 Fourier Analysis (Generalized)

For over a half century, a wide range of problems have been investigated in this field. The books [A], [B], [I] and [M] are concerned with this subject. The papers [47]–[49] are dealing with recent developments in this field.

3 Teaching Activities

Aug 1996 – Present	Emeritus Professor, University of Texas at Arlington;
1979 – 1996	Professor, University of Texas at Arlington;
1978 – 1979	Visiting Professor, University of Tennessee;
Spring 1978	Visiting Professor, University of Rhode Island;
1968 – 1977	Professor, University of Iasi;
1973 – 1974	Visiting Professor, University of Rhode Island;
1967 – 1968	Visiting Professor, University of Rhode Island;
1962 – 1967	Associate Professor, University of Iasi;
1955 – 1962	Lecturer, University of Iasi;

1950 – 1955 Assistant, University of Iasi;
 1949 – 1950 Teaching Assistant, University of Iasi.

4 Administrative

1998 – Present Emeritus President, American Romanian Academy;
 1995 – 1998 President, American Romanian Academy of Arts & Sciences;
 1982 – 1995 Counselor and member of the Executive Committee, American Romanian Academy of Arts and Sciences;
 1972 – 1977 Vice Rector, University of Iasi, 1972–1977 (on leave, 1973–1974).
 In charge of research and graduate studies;
 1968 – 1972 Dean of the Mathematics Faculty, University of Iasi;
 1966 – 1967 Rector (President) of the Teachers Training College in Suceava (today the Stefan cel Mare University of Suceava);
 1964 – 1967 Head (Chairman) of the Mathematical Division at the Teachers Training College in Suceava.

5 Memberships

American Mathematical Society, Society for Industrial and Applied Mathematics, Mathematical Association of America, American Romanian Academy of Arts and Sciences, Romanian Academy (Bucharest), Phi Beta Delta (International Scholars), International Federation of Nonlinear Analysts.

6 Editorial Activity

Editor:

1981 - Present Libertas Mathematica, the Mathematical Journal of the American Romanian Academy of Arts and Sciences.

Associate Editor:

2001 – Present Nonlinear Dynamics and Systems Theory (Kiev, Ukraine);
 2001 – Present Nonlinear Functional Analysis and Applications (Korea);
 1996 – Present Annals of Ovidius Univ. (Constantza, Romania);
 1995 – Present Functional Differential Equations (Israel);
 1994 – Present Communications on Applied Nonlinear Analysis (U.S.A.);
 1979 – 1995 Journal of Integral Equations and Applications (U.S.A.);
 1988 – 1992 Differential and Integral Equation (U.S.A.);
 1977 – 1985 Nonlinear Analysis - Theory, Methods and Applications (U.K.);
 1973 – 1978 Revue Roumaine de Math. Pures Appl. (Romania);
 1969 – 1977 and 1996 – Present Analele Stiintifice Univ. Iasi (Romania);
 1967 – 1975 Mathematical Systems Theory (Germany).

7 Awards

2010 Honorary Doctor, University of Ekaterinburg, Russia;
 2003 Doctor Honoris Causa, Stefan cel Mare Univ., Suceava, Romania;
 2003 Best Paper Award, CASYS'03, Liege, Belgium;

- 2002 "V. Pogor" Prize of the Municipality of Iasi;
 2001 Medal of Merit in Mathematics from the Union of Czech Mathematicians;
 1999 Doctor Honoris Causa, Transylvania University, Brasov, Romania;
 1994 Doctor Honoris Causa, University of Iasi, Romania;
 1994 Doctor Honoris Causa, Ovidius University, Constantza, Romania;
 1991 Distinguished Research Award, University of Texas at Arlington;
 1974 Elected Correspondent Member of the Romanian Academy of Sciences in Bucharest, Division of Mathematical Sciences;
 1963 The Research Award of the Romanian Academy of Sciences, for research work in "Stability Theory of Automatic Control Systems";
 1961 The Research Award of the Department of Education in Bucharest, for research conducted in connection with "Comparison Method in Stability Theory".

8 Invited Lectures (Colloquium Programs, Exchange Programs)

1. Belgium: The University of Louvain (1971, 1976).
2. Canada: The University of Montreal (1973); McGill University (1987); Montreal Polytechnic (1989); University of Victoria (1993); Univ. of Waterloo (1994).
3. Czechoslovakia: The Mathematical Institutes of the Academies of Sciences, and the Universities in Prague, Brno and Bratislava (1962, 1966, 1971).
4. Morocco: The University of Marrakech (1994, 1995).
5. United Kingdom: The Universities of Warwick, Durham and Sussex (1971, 1973); The University of Wales (1989); The University of Dundee (1992); Univ. of Strathclyde (1994).
6. Italy: The Universities in Milano, Florence, Perugia, Naples, and Politecnico in Torino (1965–1993).
7. Japan: Okayama University of Science (2004).
8. West Germany: Technical University in Aachen (1986).
9. Chile: The University of Osorno (2002).
10. U.S.A.: Arizona State, Brown, Case Western Reserve, Cornell, Drexel, Florida State, Southern Methodist, Texas Christian, and Wichita State Universities; the Universities of Rhode Island, Florida at Gainesville, Georgia at Athens, Colorado at Boulder, Colorado at Colorado Springs, Tennessee at Knoxville, Maryland at College Park, South Florida, Arizona at Tucson, Southern California, Wisconsin at Madison, Texas at Arlington, Dallas at Irving, New Mexico at Albuquerque, California at Los Angeles, Utah at Salt Lake City, Miami at Coral Gables; Bishop College in Dallas, Pomona Colleges, Rensselaer Polytechnic Institute, Georgia Institute of Technology, Virginia Polytechnic Institute and State University; Ohio University, University of Pittsburg, University of Houston (Downtown); Howard University, Washington, D. C.; Virginia State University, Petersburg (1968 – Present).

9 List of Monographs and Books by C. Corduneanu

- [A] *Funcții aproape periodice*. Editura Academiei, Bucharest, 1961.
 [B] *Almost Periodic Functions*. John Wiley & Sons, New York, 1968 (translation of [A], enlarged: with N. Gheorghiu and V. Barbu).
 [C] *Principles of Differential and Integral Equations*. Allyn & Bacon, Inc., Boston, 1971.
 [D] *Differential and Integral Equations*. Univ. of Iasi Press, 1971. [Romanian]

- [E] *Integral Equations and Stability of Feedback Systems*. Academic Press, Inc., New York, 1973.
- [F] *Differential and Integral Equations*. Univ. of Iasi Press, 1977. (with an Appendix by N. Pavel). [Romanian]
- [G] *Principles of Differential and Integral Equations*. 2nd Ed., Chelsea Publ. Co., The Bronx, New York, 1977.
- [H] *Principles of Differential and Integral Equations*. Stereotype edition of [G]. (This edition is currently distributed by the American Math. Society and Oxford Univ. Press).
- [I] *Almost Periodic Functions*. Chelsea Publ. Co., The Bronx, New York, 1989. The second English Edition, enlarged. This edition is currently distributed by the American Math. Society and Oxford Univ. Press.
- [J] *Integral Equations and Applications*. Cambridge Univ. Press, 1991.
- [K] *Functional Equations with Causal Operators*. Taylor and Francis, London, 2002; (Kindle edition, 2007, distributed by amazon.com).
- [L] *Integral Equations and Applications*. A paperback edition at Cambridge University Press, 2008.
- [M] *Almost Periodic Oscillations and Waves*. Springer Verlag, 2009.
- [N] *Special Topics in Functional Equations*. (In preparation; jointly with Y. Li and M. Mahdavi).

10 List of Corduneanu's Selected Papers

- [1] Approximation and stability of solutions of hyperbolic equations with characteristic data. *Comm. Acad. R.P.R.* **V** (1955) 21–26. [Romanian]
- [2] On a boundary value problem for second order nonlinear differential equations. *Analele Stiintifice Univ. Iasi, N.S.* **1** (1955) 11–16. [Romanian]
- [3] Differential systems with bounded solutions. *Comptes Rendus Acad. Sci. Paris* **245** (1957) 21–24. [French]
- [4] Differential equations in Banach spaces; Theorems of existence and continuability. *Rendiconti Accad. Naz. Lincei* **XXIII** (1957) 226–230. [Italian]
- [5] On the existence of bounded solutions for nonlinear differential systems. *Annales Polonici Math.* **V** (1958) 103–106. [French]
- [6] On conditional stability under constantly acting disturbances. *Acta Scientiarum Math. Szeged* **XIX** (1958) 229–237. [French]
- [7] On boundary value problems for differential systems. *Rendiconti Mat. Napoli* **XXV** (1958) 98–106 [Italian]
- [8] On asymptotic stability. I. *Analele Stiintifice Univ. Iasi* **V** (1959) 37–40. [French]
- [9] On asymptotic stability. II. *Revue Roumaine Math.* **V** (1960) 209–213. [French]
- [10] On the existence of bounded solutions to some classes of nonlinear differential systems. *Doklady Akad. Nauk SSSR* **131** (1960) 735–737. [Russian]
- [11] Application of differential inequalities to stability theory. *Analele Stiintifice Univ. Iasi* **VI** (1960) 47–58. [Russian]
- [12] On some nonlinear differential systems. *Ibidem* 257–260. [French]
- [13] Global existence theorems for differential systems with delayed argument. *Studii Cercetari Mat. Iasi* **XII** (1961) 249–258. [Romanian] (Russian version in the *Proceedings of ICNO Symp.* Kiev, 1961).
- [14] An integral equation from the theory of automatic control. *Comptes Rendus Acad. Sci. Paris* **256** (1963) 3564–3567. [French]
- [15] On partial stability. *Revue Roumaine Math.* **IX** (1964) 229–236. [French]
- [16] Some problems concerning stability theory. *Abhandl. Deutsch. Akad. Wissensch. zu Berlin (Math-Physik Klasse)* (1) (1965) 143–156. (Invited paper at the Equadiff Conf.) [French]
- [17] Global problems in the theory of Volterra integral equations. *Annali Mat. Pura Appl.* **67** (1965) 349–363. [French]

- [18] Some qualitative problems in the theory of integro-differential equations. *Colloquium Mathematicum* **18** (1967) 77–87. (Invited paper at the Balaton Conference 1956). [French]
- [19] Some perturbation problems in the theory of integral equations. *Mathematical Systems Theory* **I** (1967) 143–153.
- [20] On certain Volterra functional equations. *Funk. Ekvacioj* **9** (1966) 119–127. [French]
- [21] Stability of linear time-varying systems. *Math. Systems Theory* **3** (1969) 151–155.
- [22] Periodic and almost periodic solutions of some convolution equations. *Trudy Fifth Int. Conf. Nonlinear Osc., Kiev* **III** (1970) 311–320.
- [23] Stability problems for some classes of feedback systems. In the volume "Eq. Diff. Fonct. non linéaires", Herman, Paris (1973) 398–405.
- [24] On partial stability for delay systems. *Annales Polonici Math.* **XXIX** (1974-1975) 357–362.
- [25] Functional equations with infinite delay. *Bolletino Unione Mat. Italiana* **11** (suppl.) (1975) 173–181.
- [26] The stability of some feedback systems with delay. *J. Math. An. Appl.* **51** (1975) 377–393 (jointly with N. Luca).
- [27] Recent contributions to the theory of differential systems with infinite delay. *Libertas Mathematica. I* (1981) 91–116.
- [28] Equations with unbounded delay; A survey. *Nonlinear Analysis, TMA* **4** (1980) 831–877 (jointly with V. Lakshmikantham).
- [29] Bounded and almost periodic solutions of certain nonlinear elliptic equations. *Tohoku Math. J.* **32** (1980) 265–278.
- [30] Almost periodic discrete processes. *Libertas Mathematica. II* (1982) 159–169.
- [31] Two qualitative inequalities. *J. Differential Equations* **61** (1985) 16–25.
- [32] Bielecki's method in the theory of integral equations. *Annales Univ. Mariae-Curie Skłodowska, Lublin* **38** (2) (1984) 23–40.
- [33] A singular perturbation approach to abstract Volterra equations. In: "Nonlinear Analysis and Applications". M. Dekker (1987) 133–138.
- [34] Perturbation of linear abstract Volterra equations. *J. Integral Equations and Appl.* **2** (1990) 393–401.
- [35] LQ-Optimal control problems for systems with abstract Volterra operators. *Tekhn. Kibernetika* (1) (1993) 132–136. [Russian] (English version in *Libertas Mathematica*)
- [36] Discrete qualitative inequalities and applications. *Nonlinear Analysis, TMA* **25** (1995) 933–939.
- [37] Neutral functional differential equations with abstract Volterra operators. In: "Advances in Nonlinear Dynamics". Gordon & Breach (A. Martynyuk, Ed.) **5** (1997).
- [38] Abstract Volterra Equations (a survey). *Mathematical and Computer Modeling* **32** (2000) 1503–1528.
- [39] Existence of solutions for neutral functional differential equations with causal operators. *Journal Differential Equations* **168** (2000) 93–101.
- [40] Absolute stability for neutral differential systems. *European J. of Control* (2002) 209–212.
- [41] Second order functional equations of neutral type. *Dynamic Systems and Applications* **14** (2005) 83–89.
- [42] A modified LQ-Optimal control problem for causal functional differential equations. *Nonlinear Dynamics and Systems Theory* **4** (2004) 139–144.
- [43] A duality principle in the theory of dynamical systems. *Nonlinear Dynamics and Systems Theory* **5** (2005) 135–140 (jointly with Y. Li).
- [44] Almost periodicity in functional equations. In: "Progress in Nonlinear Differential Equations and their Applications", Birkhauser (V. Staicu, Ed.) **75**, 2007.
- [45] Boundedness of solutions for a second order differential equations with causal operators. *Nonlinear Studies* **18** (2011) 135–139.

[46] A scale of almost periodic functions spaces. *Differential and Integral Equations* **24** (2011) 1–24.

[47] Formal trigonometric series, almost periodicity and oscillatory functions (to appear).

[48] Elements of an axiomatic construction of the theory of almost periodic functions (to appear). [French]

[49] Searching for generalized Fourier exponents associated with series of oscillatory functions (to appear).