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International Symposium "Actual Problems of Mathematics and Informatics" dedicated to the 90th birthday of professor Ion Valutse

Mitrofan Cioban, Dumitru Cozma, and Leonid Dohotaru

November 27-28, 2020, Technical University of Moldova (TUM) and Tiraspol State University (TSU) in collaboration with Romanian Society of Applied and Industrial Mathematics (ROMAI), Mathematical Society of the Republic of Moldova and Academy of Sciences of Moldova held the symposium on the actual problems of the mathematics and informatics, dedicated to the 90th Birthday of Professor Ion Valuţă (Valutse). The symposium brought together over 100 researchers from Romania, Spain, Canada, Russia, India, Bulgaria, the Republic of Moldova who presented 61 scientific papers. The works were carried out in three sections: Mathematics; Computer science and its theoretical mathematical bases; Didactics and Education. In the opening speech of rector Professor V. I. Bostan, communicated by the vice-rector professor M. Vernic, and in the opening report of academician M. M. Choban "Professor Ion Valuţă - teacher of many generations of students" it was mentioned that this symposium is dedicated to a Man-phenomenon, with an exceptional story of work and life, with an essential contribution in the organization of higher education and of scientific research in the Republic of Moldova - to the mathematician professor Ion Valuţă, who recently turned the venerable age of 90 years old.

The work of Symposium includes plenary and sections communications. At the plenary sessions, the reports contain an overview of the results obtained over the previous years in one direction or another, and the unsolved problems are posed as well. Were presented the following nine plenary communications:

(1) Alexander V. Arhangel'skii (Russia). *A Note on some Open Problems in Topological Algebra*.

(2) Viorel Bostan (Republic of Moldova), Ion Bostan (Republic of Moldova), Maxim Vaculenco (Republic of Moldova). *Mathematical modeling of teeth contact in precessional transmission*.

(3) Inga Titchiev (Republic of Moldova), Constantin Gaindric (Republic of Moldova). *Perspective research at the "Vladimir Andrunachievici" institute of mathematics and computer science*.

(4) Joan C. Artes (Spain), Jaume Llibre (Spain), Dana Schlomiuk (Canada), Nicolae Vulpe (Republic of Moldova), *Abel quadratic differential systems of second kind*.
(5) Vasile Berinde (Romania). *A simple ODE mathematical model to assess the effectiveness of facemask wearing in COVID-19 pandemic*.
(6) Liubomir Chiriac (Republic of Moldova). *Evolutions and trends in the study of real sciences in the Republic of Moldova.*
(7) Costica Morosanu (Romania). *Numerical simulations of phase-field transitions in 1D case, via a nonlinear and nonlocal reaction-diffusion equation of second-order.*
(8) Marcel Teleuca (Republic of Moldova), Larisa Sali (Republic of Moldova). *Training the skills to use notions of physics to solve geometry problems.*
(9) Ion I. Valutse (Republic of Moldova). *On the waves of the past.*

The first three plenary reports, and those of M. M. Cioban, are published in the present volume.

Objects of topological algebra, defined as a certain combination of algebraic and topological structures, often give rise to original and unusual questions. A special additional topological property of many topological spaces of this kind is homogeneity. In the communication of Professor Alexander V. Arhangel'skii some open problems of topological algebra are analyzed.

In the communication of Professor Viorel Bostan, Academician Ion Bostan and Professor Maxim Vaculenco as a result of the analysis of the mathematical models of the multipair convex-concave teeth contact in processional gearing multipairs the following conclusions and recommendations are obtained:

(1) The mathematical modeling of the surfaces of machine parts interpreted on computerized CAD/CAM/CAE design, research and manufacturing platforms in the near future will revolutionize the global change of machine tool park architecture of machine parts manufacturing plants and will also generate enormous social consequences in the field of training of specialists of all levels.
(2) The development of the CAD/CAM/CAE design-manufacturing platform based on mathematical models facilitates the replacement of the classic parts manufacturing processes with new manufacturing technologies on numerically controlled machine tools and additive technologies with 3D printers.

(3) The CAD/CAM/CAE platform based on mathematical models of constructive functional interpretation of machine assemblies, changes the paradigm of achieving the idea in industrial product in much smaller terms and with much lower costs.

(4) The first three conclusions will impose harsh conditions for an essential change in the content of the training of specialists at university, college and vocational education and training professional levels.

In the communication of Director of Institute of Mathematics and Computer Sciences dr Inga Titchiev and Academician Constantin Gaindric is described the relevance and benefits of research conducted in the field of computer science at the Vladimir Andrunachievici Institute of Mathematics and Computer Science.

In the communication of Professors J. C. Artes, Jaume Llibre, Dana Schlomiuk and Academician Nicolae Vulpe are studied the quadratic differential systems of second kind, named Abel after Niels Henrik. Here they consider the Abel quadratic polynomial differential equations of second kind denoting this class by QS_{Ab}. Firstly the authors split the whole family of non-degenerate quadratic systems in four subfamilies according to the number of infinite singularities. Secondly for each one of these four subfamilies they determine necessary and sufficient affine invariant conditions for a quadratic system in this subfamily to belong to the class QS_{Ab}. Thirdly were classify all the phase portraits in the Poincare disc of the systems in QS_{Ab} in the case when they have at infinity either one triple singularity (21 phase portraits) or an infinite number of singularities (9 phase portraits). Moreover was determined the affine invariant criteria for the realization of each one of the 30 topologically distinct phase portraits. To obtain these criteria was applied the theory of algebraic invariants of polynomial differential systems, developed by Sibirsky and his disciples.

In his communication Profesor Vasile Berinde has mentioned: I am teaching ODE and PDE to Engineering, Mathematics and Computer Science undergraduate students since 1990, see for example the textbooks: Berinde V., Petracovici B. *Ecuaţii diferenţiale*, Universitatea din Baia Mare, 1992; Berinde V., Horvat-Marc A. *Ecuaţii diferenţiale şi cu derivate parţiale*, Cub Press, Baia Mare 2006. One of my first attempts when I start the ODE course (and later, the PDE course) is to try to persuade my students on how important are for science and technology the mathematical models built by means of differential equations. Usually, I present a simple population model, in the case of ODE, while for the course of PDE I just anticipate the importance of heat equation in modelling the weather forecast (Cernea A. *Elemente de teoria ecuaţiilor diferenţiale*, Editura Universităţii din Bucureşti, Bucureşti 2010). Starting from this background,

the main aim of this presentation is to show, by means of a simple ODE mathematical model, how are differential equations used in studying various aspects of the COVID-19 pandemic, which, in the last 9 months or so has changed dramatically our lives, our professional activity as well as our view and perception of the microscopic world (Cajal N., Iftimovici R. *Lumea virusurilor*, Editura Tineretului, Bucureşti 1962; Cajal N., Iftimovici R. *Oameni contra virusuri*, Editura Albatros, Bucureşti 1974; de Kruif P. *Microbe Hunters*, Harcourt Brace Jovanovich, Publishers, San Diego- New York - London 1954). We present a simple modeling process able to examine the dynamics of COVID-19 epidemics when face mask is worn by the population members, with or without imposed lock-down periods.

Professor Costica Morosanu in his communication compared three methods (of fractional-step and implicit-explicit type for the approximation in time, and finite differences in space) to solve local and non-local reaction-diffusion equations of second-order, with non-homogeneous Neumann boundary conditions. Two sets of numerical tests are presented, done for the Allen-Cahn equation - a typical example for the cubic nonlinearity, modeling moving interface problems, and analyzed in terms of the physical quantities of interest (diffusion, reaction). In the non-zero flux case ($w \neq 0$), the Non-local Newton test yields an interface function with values around zero across the space interval, the Local Newton pushes the interface function to one in whole the space domain, while the Nonlocal Factional Step shows a phase change between -1 to +1 around the center of the interval.

Professor Liubomir Chiriac in his communication mentioned that in recent decades, a new conception of human existence has been foreshadowed. The Council of Europe Recommendation of 22 May 2018 on key competences for lifelong learning sets out the skills needed for a constantly changing way of life, which requires adaptation and lifelong learning. We emphasize in this regard: "promoting the acquisition of skills in science (S), technology (T), engineering (E) and mathematics (M) (STEM), taking into account their links with the arts, creativity and innovation and motivation of more young people, especially girls and young women, to adopt a career in STEM fields". To remedy the situation, in several developed countries, the STEAM concept is implemented in the educational system, which involves the integrated study of several real disciplines, especially science (S), technique (T), engineering (E) and mathematics (M). Thus, interdisciplinary must be conceived not only in the sense of integrating knowledge, but also as a way of thinking and acting. The interdisciplinary perspective consists essentially in familiarizing students with general interdisciplinary principles, knowledge and methods, which could be applied in as diverse contexts as possible to solve real problems. In the present discussion we

will refer to some results obtained by the team of researchers from the State University of Tiraspol.

Professors Marcel Teleuca and Larisa Sali in their plenary talk mentioned that the modernized national curriculum in mathematics recommends middle and high school teachers to carry out group / individual projects, including STEM / STEAM projects, that demonstrate how it is possible to apply mathematical knowledge in real and / or modeled situations. Numerous didactic publications are devoted to the applications of mathematics in solving problems in various fields. However, the application of knowledge from other fields in solving mathematical problems is rarely encountered in didactic works. The authors selected several types of mathematical problems that can be solved through knowledge from physics. In particular, they described in detail how to more easily solve some geometry problems related to the similarity of shapes, the identification of remarkable points, the application of metric relations, etc., using: the lever rule, center of gravity, moment of inertia of a system of material points, and others. The methods of solving the problems proposed in this paper can be recommended to teachers and students for extending or deepening their knowledge in mathematics and for raising awareness of the meaning of the involved physical notions and phenomena.

In the last plenary communication "On the waves of the past", Professor Ion I. Valutse, realizing his life story, highlighted several important events in higher education of post-war Basarabia, but also in mathematical sciences, in which he played an important role and which were closely linked with his destiny.

The communications in the sections contain deep and interesting results from various fields of mathematics, informatics, theoretical bases of informatics, mathematics and applied informatics, psycho-pedagogy of mathematics and informatics. The themes of these communications are reflected in the following program.

International Symposium

"ACTUAL PROBLEMS OF MATHEMATICS AND INFORMATICS"

dedicated to the 90th Birthday of Professor Ion Valutse

PROGRAM

27th November

14:00. Opening Session

Viorel BOSTAN, Rector of the Technical University of Moldova.
Mitrofan CIOBANU, Academician of Academy of Sciences of Moldova.

Plenary Session

Chairman: Mitrofan CHOBAN

14:20 - 15:05 - Viorel BOSTAN, Ion BOSTAN, Maxim VACULENCO. Mathematical modeling of teeth contact in precessional transmission.

15:05 - 15:50 - Vasile BERINDE. A simple ODE mathematical model to assess the effectiveness of facemask wearing in COVID-19 pandemic.

15:50 - 16:35 - Joan C. ARTES, Jaume LLIBRE, Dana SCHLOMIUK, Nicolae VULPE. Abel quadratic differential systems of second kind.

16:35 - 17:15 - Costica MOROŞANU. Numerical simulations of phase-field transitions in 1D case, via a nonlinear and nonlocal reaction-diffusion equation of second-order.

Break

Section 1. Mathematics

Chairman: Dumitru COZMA

17:25 - 17:45 - David CHEBAN. Perron-Frobenius Dynamics for Markov Chains.

17:45 - 18:05 - Dumitru COZMA, Angela MATEI. On integrability of homogeneous fractional quadratic differential equation.

18:05 - 18:20 - Vasile NEAGU. On boundedness of the operator with Cauchy kernel on the real axis.

18:20 - 18:35 - Vasile I. URSU. About algebraic characterization of quasi-varieties of loops.

18:35 - 18:50 - Leonid A. URSU. General form of autotopies of 3-IP-loop.

18:50 - 19:05 - Andrei PERJAN, Galina RUSU. Two parameter singular perturbation problems for sine-Gordon type equations.

19:05 - 19:20 - Mihai N. POPA, Victor V. PRICOP. Four-dimensional reductive Lie algebra for the ternary differential system with quadratic nonlinearities and its perspectives in the study of this system.

19:20 - 19:35 - F. L. DAMIAN, P. V. MACAROV. On star regular equidistant polyhedrons in Lobachevsky space.

19:35 - 19:50 - Mitrofan M. CHOBAN, Ekaterina MIHAYLOVA. Family of subspaces with bases of countable order.

Section 2. Computer science and its theoretical mathematical bases

Chairman: Alexei LEAHU

17:25 - 17:40 - Alexei LEAHU, Veronica ANDRIEVSCHI-BAGRIN, Dumitru CIORBA, Ion FIODOROV. Min(max-psd) and max(min-psd) distributions as a lifetime distributions in network's reliability.

17:40 - 17:55 - Constantin CIUBOTARU. Generarea şi utilizarea imaginilor în studierea automatelor finite.

17:55 - 18:10 - Ion BOLUN, Dumitru CIORBA, Aureliu ZGUREANU, Rodica BULAI, Rostislav CĂLIN, Cristina BODOGA. State of infosecurity in the Republic of Moldova.

18:10 - 18:25 - SPÎNU Lavinia. Artificial Intelligence-The Lack of Privacy.

18:25 - 18:40 - Andrei CORLAT. Reliability analysis of some complex systems with time redundancy.

18:40 - 18:55 - Liubomir CHIRIAC Metode de construcţie a quasigrupurilor mediale şi paramediale1.

18:55 - 19:10 - Tatiana PAŞA. Solving the non-linear transportation problem on network.

19:10 - 19:25 - Vitalie ŢICĂU, Stela ŢICĂU. Aplicarea metodelor numerice la rezolvarea ecuaţiilor polinomiale.

19:25 - 19:40 - Olga CERBU, Anatolie CERBU, Ghenadie DONCENCO (masterand), Veaceslav IURCO (elev). Abordări metodice în utilizarea algoritmilor iterativi în construirea unei triangulaţii Delaunay şi implementarea în limbajul java.

Section 3. Didactics and Education

Chairman: Andrei CORLAT

17:25 - 17:40 - Andrei CORLAT, Ion JARDAN. Unele aspecte ale integrării funcţiilor raţionale

17:40 - 17:55 - Andrei CORLAT, Ion JARDAN. Aplicarea monotoniei funcţiilor la rezolvarea ecuaţiilor

17:55 - 18:10 - Viorica SUDACEVSCHI, Victor ABABII, Silvia MUNTEANU, Radu MELNIC, Viorel CĂRBUNE. Sistem bazat pe tehnologii labview pentru predarea la distanţa a disciplinelor inginereşti.

18:10 - 18:25 - Valeriu GUŢU. Geometric aspects in teaching the course "Differential Equations".

18:25 - 18:40 - Violeta BOGDANOVA. Metodologia implementarii conceptului "eliminarea decalajului digital" în procesul studierii disciplinei "Securitatea Informaţionala".

18:40 - 18:55 - Marina BOSTAN. Aspecte didactice în pregatirea experimentului pedagogic privind implementarea TIC în predarea cursului universitar "Teoria Grafurilor".

18:55 - 19:10 - Teodora VASCAN. Aspecte didactice privind realizarea legăturilor interdisciplinare Informatică-Matematică la treapta gimnaziala.

19:10 - 19:25 - Ana GASNAŞ, Angela GLOBA. Experienţa invăţării online in condiţiile pandemiei COVID-19.

19:25 - 19:40 - Leonid DOHOTARU, Victor ORLOV Despre unele aplicaţii ale numerelor complexe în geometrie.

19:40 - 19:55 - Maria PAVEL, Dorin PAVEL. Recomandări şi soluţii tehnice în invăţământul online.

28th November

Plenary Session

Chairman: Mitrofan CHOBAN

09.00 - 09:25 - Alexander V. ARHANGEL'SKII. A Note on some Open Problems in Topological Algebra.

09.25 - 09:50 - Inga TITCHIEV, Constantin GAINDRIC. Perspective research at the "Vladimir Andrunachievici" institute of mathematics and computer science.

09.50 - 10:15 - Liubomir CHIRIAC. Evolutions and trends in the study of real sciences in the Republic of Moldova.

10.15 - 10.40 - Marcel TELEUCĂ, Larisa SALI. Training the skills to use notions of physics to solve geometry problems.

10:40 - 11:10 - Ion I. VALUŢĂ. On the waves of the past.

11:10-11:30 Break

Section 1. Mathematics

Chairman: Florin DAMIAN

11.30 - 11.45 - Ion JARDAN. Some particular cases for inverse operations in the class of preradicals in modules.

11.45 - 12.00 - Vadim REPEŞCO. A qualitative study of the cuartic system with maximal multiplicity of the line at the infinity.

12.00 - 12.15 - G. HOROSH, N. MALYUTINA, A. SCERBACOVA, V. SHERBACOV. Units in generalized derivatives of quasigroups.

12.15 - 12.30 - Mariana-Geanina ZAHARIA. Applications of some special number sequences and quaternion elements using Fibonacci and Lucas elements.

12.30 - 12.45 - Mitrofan M. CHOBAN, Ion I. VALUŢĂ. On the semigroup of endomorphisms of a topological universal algebra.

12.45 - 13.00 - Dumitru BOTNARU, The group of c-reflective subcategories.

13.00 - 13.15 - Alina ŢURCANU. The left and the right products, and the relative torsion theories.

13.15 - 13.30 - Iurie BALTAG, On some determination solutions of the stationary navier-stokes equation.

13.30 - 13.45 - Ion LEAH, Hiperboloidul cu o panza ca reţea algebrică.

13.45 -14.00 - Olga CERBU, Reflective functors and factorization structures

Section 2. Computer science and its theoretical mathematical bases

Chairman: Victor ABABII

11.30 - 11.45 - Abhishek PANDEY, V. RAMESH. A Study on Deep Learning Algorithms and Architectures.

11.45 - 12.00 - Dorin AFANAS, Andrei BRAICOV. STEAM education in search missions.

12.00 - 12.15 - Elena CEBOTARU. Computer Algebra Methods for linearization of the normal form Birghoff.

12.15 - 12.30 - Lidia POPOV, Vitalie ŢICĂU. Learning microsoft excel software using video sequences.

12.30 - 12.45 - A. DANILOV, L. CHIRIAC. Studierea sistemului criptografic simetric ElGamal.

12.45 - 13.00 - Viorel BOSTAN, Ion BOSTAN, Valeriu DULGHERU, Oleg CIOBANU. Some aspects regarding torque study and elaboration of the blades orientation mechanism for mycrohydropower pland.

13.00 - 13.15 - Marin GUŢU. Importanţa matematicii aplicate în soluţionarea provocărilor/problemelor din lumea reală.

Section 3. Didactics and Education

Chairman: Leonid DOHOTARU

11.30 -11.45 - Laurenţiu CALMUŢCHI. Dividing the figures into equivalent parts.

11.45 - 12.00 - Marina DARIENKO. Certain features of teaching the basis of probability theory in secondary vocational education.

12.00 - 12.15 - Iurie BALTAG. Cu privire la poziţia reciprocă a unei drepte şi a unei suprafeţe de ordinul doi şi a determinării distanţei minime dintre ele.

12.15 - 12.30 - Serghei MAFTEA. Aspecte privind metoda inducţiei matematice.

12.30 - 12.45 - Natalia LUPAŞCO, Liubomir CHIRIAC, Natalia JOSU, Lilia MIHALACHE. Aspecte didactice privind studierea roboticii şi mecatronicii în sistemul preuniversitar.

12:45 - Closing Ceremony

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