
Dr. Vladimir Martinusi
Mathematician, Research Scientist
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Education

- 2006 – 2010: Ph.D. in Industrial Engineering, Technical University “Gheorghe Asachi” Iasi, Romania. Thesis title: *Lagrangian and Hamiltonian Formulations in Relative Orbital Dynamics. Applications to Spacecraft Formation-Flying and Satellite Constellations*. Advisor: Professor Alfred Braier.
 - 2005 – 2006: M.Sc. in Industrial Engineering, Technical University “Gheorghe Asachi” Iasi, Romania. Dissertation Title: *Relative Orbital Motion in Keplerian Force Fields. Applications in Space Rendezvous Missions*. Advisor: Professor Daniel Condurache.
 - 1995 – 1999: B.Sc. in Pure Mathematics, “Alexandru Ioan Cuza” University, Iasi, Romania. Dissertation title: *Viability of Differential Inclusions*. Advisor: Professor Ovidiu Carja.
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Work Experience

- 2016 – present: Research Scientist (Ingénieur de recherche), Multibody & Mechatronic Systems Lab, Department of Aerospace and Mechanical Engineering, University of Liège, Belgium.
Developing numerical methods for model order reduction, to be applied in the Oofelie platform – a multiphysics software developed by Open Engineering - Numeca and University of Liège;
- 2013 – 2016: Postdoctoral Researcher, Space Structures and Systems Lab (S3L), Department of Aerospace and Mechanical Engineering, University of Liège, Belgium.
Developing analytic models through special perturbations methods for low-Earth orbiting satellites. Results up to date: time-explicit propagators for the absolute and the relative motion of satellites under the influence of the Earth oblateness and atmospheric drag;
- 2010 – 2013: Postdoctoral Research Fellow at the Distributed Space Systems Lab (DSSL), Asher Space Research Institute, Faculty of Aerospace Engineering, Technion – Israel Institute of Technology.
Conducting research in fundamental Astrodynamics, with application to orbit design, orbit prediction, relative orbital motion, formation flying, satellite clusters, distributed space systems. Results: long-term boundedness analytic conditions for formation flying under the influence of the Earth oblateness, optimal impulsive maneuvers for station-keeping and formation-keeping accommodating gravitational perturbations).
- 2004 – 2010: Technical University “Gheorghe Asachi” Iasi, Romania. Lecturer in the Department of Theoretical Mechanics.
Research: Perturbation methods for conservative (Hamiltonian) systems, applied to the absolute and the relative motion of satellites. Closed-form solutions to fundamental problems in Theoretical mechanics (the Foucault Pendulum, Kepler’s problem in non-inertial reference frames), Fundamentals of robotics (attitude kinematics) and applied Mathematics (Riccati equations, tensor calculus). Teaching: Theoretical Mechanics, Fundamentals of Robotics, Linear Algebra, Analytic Geometry.
- 1999 – 2004: “Emil Racovita” National College, Iasi, Romania. Lecturer in Mathematics.
Besides teaching, I was preparing the Romanian team for the International Olympiad of Mathematics and I was a committee member of the National Olympiad of Mathematics.

Invited Talks

- 2015: Technical University of Braunschweig, Germany: *Satellite Orbit Prediction – Analytic Approaches to Perturbations*.

International Courses

- On September 10-12, 2015, I have organized an International Astrodynamics Short Course at the University of Liège. I have given lectures on orbital mechanics and perturbation theory.
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Teaching Experience

- **Lectures in Astrodynamics**, Department of Aerospace and Mechanical Engineering, University of Liège, Belgium.
- **Lectures and tutorials in Theoretical Mechanics**, at the Faculties of Electrical Engineering, Computer Engineering and Civil Engineering, at the Technical University “Gheorghe Asachi” Iasi, Romania.
- **Lectures and tutorials in Fundamentals of Robotics**, Faculty of Computer Engineering, Technical University “Gheorghe Asachi”, Iasi, Romania.
- **Lectures and tutorials in System Modelling and Simulation**, Faculty of Electrical Engineering, Technical University “Gheorghe Asachi”, Iasi, Romania.
- **Lectures and tutorials in Simulation of Mechanical Systems**, Faculty of Automatic Control and Computer Engineering, Technical University “Gheorghe Asachi”, Iasi, Romania.
- **Tutorials in Linear Algebra and Analytic Geometry**, Faculty of Electrical Engineering, Technical University “Gheorghe Asachi”, Iasi, Romania.

Professional Service & Membership

- Reviewer for Celestial Mechanics and Dynamical Astronomy.
- Reviewer for AIAA Journal of Guidance, Control, and Dynamics (excellent reviewer title granted in 2012 and 2015).
- Reviewer for Advances in Space Research.
- since 2001: member of the Romanian Mathematical Society (Societatea de Stiinte Matematice din Romania) (SSMR)

Research Grants

- 2013 – 2015: Principal Investigator, Marie Curie BEIPD-COFUND Postdoctoral Grant “Advanced Analytic Models in the Dynamics of Satellite Clusters”, University of Liège, Belgium.

Awards:

- 2010–2012: Sam&Cecilia Neaman Postdoctoral Fellowship, Technion – Israel Institute of Technology.
- 2013 – 2015 Marie Curie BEIPD-Cofund Postdoctoral Fellowship, University of Liège, Belgium.

Computer Skills

- Matlab (& Simulink), STK, Maple, Mathematica, Latex, CorelDraw, Photoshop.

Language Skills

- **Romanian** – mother tongue;
- **English** – full professional proficiency;
- **French** – full professional proficiency;
- **Italian** – medium proficiency;
- **Hebrew** – basic conversational level.

Referees

- **Prof Olivier Brùls**, Professor, Department of Aerospace and Mechanical Engineering, University of Liège, Belgium.
E-mail: O.Bruls@ulg.ac.be
- **Prof Gaëtan Kerschen**, Professor, Department of Aerospace and Mechanical Engineering, University of Liège, Belgium.
E-mail: g.kerschen@ulg.ac.be
- **Prof. Pini Gurfil**, Associate Professor, Distributed Space Systems Lab, Faculty of Aerospace Engineering, Technion – Israel Institute of Technology.
E-mail: pgurfil@technion.ac.il
- **Prof. Daniel Condurache**, Professor, Head of Department of Theoretical Mechanics, Technical University "Gheorghe Asachi", Iasi, Romania.
E-mail: daniel.condurache@gmail.com
- **Dr. Alexander Kogan**, Technion – Israel Institute of Technology.
E-mail: akogan@tx.technion.ac.il
- **Dr. Martin Lara**, Astrodynamics consultant.
E-mail: mlara0@gmail.com
- **Prof. Juan Félix San Juan**, Departamento de Matemáticas y Computación, Universidad de La Rioja, Spain.
E-mail: juanfelix.sanjuan@unirioja.es.

Selected Refereed Journal Papers

1. Martinusi, V., Dell'Elce, L. and Kerschen, G., *First-Order Analytic Propagation of Satellites in The Exponential Atmosphere of an Oblate Planet*, Celestial Mechanics and Dynamical Astronomy, vol. 127, No. 4, 2017, pp. 451–476.
2. Martinusi, V., Dell'Elce, L. and Kerschen, G., *Analytic Propagation of Near-Circular Satellite Orbits in The Atmosphere of An Oblate Planet*, Celestial Mechanics and Dynamical Astronomy, Vol. 123, No. 1, 2015, pp. 85-103.
3. Martinusi, V., Gurfil, P., *Analytical Derivation of Single-Impulse Maneuvers Guaranteeing Bounded Relative Motion Under J_2* , Journal of Guidance, Control, and Dynamics, vol. 37, No. 1, 2014, pp. 233-242.
4. Martinusi, V., Gurfil, P., *Analytical Solutions for J_2 -Perturbed Unbounded Equatorial Orbits*, Celestial Mechanics and Dynamical Astronomy, Vol 115, No. 1, 2013, pp. 35-57.
5. Martinusi, V., Gurfil, P., *Solutions and Periodicity of Satellite Relative Motion Under Even Zonal Harmonics Perturbations*, Celestial Mechanics and Dynamical Astronomy, Vol. 111, No. 4, 2011, pp. 387-414.
6. Condurache, D.; Martinusi, V., *A Quaternionic Exact Solution to the Relative Orbital Motion Problem*, Journal of Guidance, Control, and Dynamics, vol. 33, no.4, 2010, pp. 1035-1047.
7. Condurache, D., Martinusi, V., *Exact Solution to the Relative Orbital Motion in Eccentric Orbits*, Solar System Research, Vol. 43, Issue 1, 2009, pp. 41-52.
8. Condurache D., Martinusi, V., *Foucault Pendulum-like Problems: A Tensorial Approach*, International Journal of Non-linear Mechanics, vol. 43, issue 8, 2008, pp. 743-760.
9. Condurache D., Martinusi, V., *A Complete Closed Form Solution to the Kepler Problem*, Meccanica, Vol. 42, no.5, 2007, pp. 465-476.
10. Condurache D., Martinusi, V., *Relative Spacecraft Motion in a Central Force Field*, Journal of Guidance, Control, and Dynamics, vol.30, no.3, 2007, pp. 873-876.
11. Condurache D., Martinusi, V., *Kepler's Problem in Rotating Reference Frames. Part I : Prime Integrals, Vectorial Regularization*, Journal of Guidance, Control and Dynamics, Vol. 30, no.1, 2007, pp. 192-200.
12. Condurache D., Martinusi, V., *Kepler's Problem in Rotating Reference Frames. Part II: Relative Orbital Motion*, Journal of Guidance, Control and Dynamics, Vol. 30, no.1, 2007, pp. 201-213.
13. Condurache D., Martinusi, V., *Vectorial Regularization and Temporal Means in Keplerian Motion*, Journal of Nonlinear Mathematical Physics, Vol.13, No.3, 2006, pp. 420-440.

Selected Refereed International Conference Papers

1. Martinusi, V., Condurache, D., *Closed-From Solution to The Attitude Kinematics Equation For An Arbitrary Angular Velocity*, AAS/AIAA Space Flight Mechanics Meeting, January 11-15 2015, Williamsburg, VA, USA.
2. Martinusi, V., Dell'Elce, L. and Kerschen, G., *Analytic Solution for The Relative Motion of Satellites in Near-Circular Low-Earth Orbits*, AAS/AIAA Space Flight Mechanics Meeting, January 11-15 2015, Williamsburg, VA, USA.
3. Dell'Elce, L., Martinusi, V. and Kerschen, G., *Robust Optimal Rendezvous Using Differential Drag*, AIAA/AAS Astrodynamics Specialist Conference, August 4-7, San Diego, CA.
4. Martinusi, V, Dell'Elce, L. and Kerschen, G., *Analytic Propagation for Satellites in Near-Circular Low-Earth Orbits*, AIAA/AAS Astrodynamics Specialist Conference, August 4-7, San Diego, CA.
5. Martinusi, V, Dell'Elce, L. and Kerschen, G., *Analytic Model for The Motion About an Oblate Planet in The Presence of Atmospheric Drag*, 2nd IAA Conference on Dynamics & Control of Space Systems, March 24-26, Rome, Italy. Paper IAA-AAS-DyCoSS2-14-11-05.

6. Condurache, D., Martinusi, V., *Analytical Orbit Propagator Based on Vectorial Orbital Elements*, AIAA Guidance, Navigation and Control Conference, 19-21 August 2013, Boston, MA, USA. Paper AIAA-2013-5188.
7. Martinusi, V., Gurfil, P., *Keplerization of Motion in Any Central Force Field*, 1st IAA Conference on Dynamics & Control of Space Systems, 2012, Porto, Portugal. Paper IAA-AAS-DyCoSS1-08-01.
8. Condurache, D., Martinusi, V., *Universal Functions in the Study of the Relative Orbital Motion*, 1st IAA Conference on Dynamics & Control of Space Systems, March 19-21, Porto, Portugal. Paper IAA-AAS-DyCoSS1-08-07.
9. Martinusi, V., Gurfil, P., *Closed-Form Solutions for Open Orbits Around an Oblate Planet*, AAS/AIAA Space Flight Mechanics Meeting, January 29 – February 2, 2012, Charleston, SC, USA. Paper AAS 12-163.
10. Condurache, D., Martinusi, V., *A Closed-Form Solution to the Two-Body Problem in Non-Inertial Reference Frames*, AAS/AIAA Space Flight Mechanics Meeting, January 29 – February 2, 2012, Charleston, SC, USA. Paper AAS 12-213.
11. Martinusi, V., Gurfil, P., *Optimal Satellite Formation Establishment about an Oblate Planet*, AIAA Guidance, Navigation, and Control Conference, 8 – 11 Aug 2011, Portland, Oregon, USA. Paper AIAA-2011-6628.
12. Condurache, D., Martinusi, V., *State Space Analysis for the Relative Spacecraft Motion in Geopotential Fields*, AIAA Guidance, Navigation, and Control Conference, 8 – 11 Aug 2011, Portland, Oregon, USA. Paper AIAA-2011-6656.
13. Martinusi, V., Gurfil, P., *Closed-Form Solutions for Satellite Relative Motion in an Axially-Symmetric Gravitational Field*, AAS/AIAA Spaceflight Mechanics Meeting, New Orleans, LA, USA, February 2011, Paper AAS 11-209.
14. Condurache, D., Martinusi, V., *Super-integrability in The Unperturbed Relative Orbital Motion Problem*, AIAA/AAS Astrodynamics Specialist Conference, Toronto, Canada, 2-5 August 2010. Paper AIAA-2010-7669.
15. Condurache, D.; Martinusi, V., *Analytic Solution to the Relative Orbital Motion Around an Oblate Planet*, AIAA Guidance, Navigation and Control Conference and Exhibit, Chicago, Illinois, 10-13 Aug. 2009. Paper AIAA-2009-6098.
16. Condurache, D.; Martinusi, V., *Hypercomplex Eccentric Anomaly in the Unified Solution to the Relative Orbital Motion*, AAS/AIAA Astrodynamics Specialist Conference, Pittsburgh, Pennsylvania, 9-13 Aug. 2009. Paper AAS 09-321. (also published in *Advances in the Astronautical Sciences*, Vol.135, 2010, pp. 281-300.)
17. Condurache, D.; Martinusi, V., *Exact solution to The Relative Orbital Motion in A Central Force Field*, IEEE/AIAA 2nd International Symposium on Systems and Control in Aerospace and Astronautics, Shenzhen, China, 10-12 Dec. 2008, DOI: 10.1109/ISSCAA.2008.4776296.
18. Condurache, D.; Martinusi, V., *A Quaternionic Exact Solution to the Relative Orbital Motion*, AIAA/AAS Astrodynamics Specialist Conference, Honolulu, Hawaii, 18-21 Aug. 2008, Paper AIAA 2008-6764.
19. Condurache, D., Martinusi, V., *Exact Solution to the Relative Orbital Motion in Eccentric Orbits*, International Conference “Analytical Methods of Celestial Mechanics”, Sankt-Petersburg, Russia, 2007.

Other Journal Papers

1. Martinusi, V., Condurache, D., *Remarks on the Hamiltonian of A Particle in A Rotating Reference Frame*, Bul. Inst. Polit. Iasi, LV(LIX), 4, Sect. Mathematics, Theoretical Mechanics, Physics, 2009, pp. 19-24.
2. Condurache D., Martinusi, V., *A Novel Hypercomplex Solution to Kepler’s Problem*, PADEU, Astronomy Department. of the Eötvös University., vol. 19, 2007, pp. 65-80.
3. Condurache D., Martinusi, V., *A Closed Form Vectorial Solution to the Relative Orbital Motion*, PADEU, Astronomy Department. of the Eötvös University., vol. 19, 2007, pp. 49-64.

4. Condurache D., Martinusi, V., *A Short Solution to the Keplerian Ballistic Problem Using the Velocity Hodograph*, Bul. Inst. Polit. Iasi, LII(LVI), 1-2, Sect. Mathematics, Theoretical Mechanics, Physics, 2007.
5. Condurache D., Martinusi, V., *The Two Body Problem in Rotating Reference Frames*, Bul. Inst. Polit. Iasi, LII(LVI), 3-4, Sect Mathematics, Theoretical Mechanics, Physics, 2005.
6. Condurache D., Martinusi, V., *Kepler's Problem in Non-Inertial Reference Frames: A Vectorial Regularization*, Bul. Inst. Polit. Iasi, LI (LV), 1-2, Sect Mathematics, Theoretical Mechanics, Physics, 2005, pp. 45-61.
7. Condurache D., Martinusi, V., *The Solution to Kepler's Problem in Non-Inertial Reference Frames*, Bul. Inst. Polit. Iasi, LI(LV), 1-2, Sect Mathematics, Theoretical Mechanics, Physics, 2005, pp. 43-55.
8. Condurache D., Martinusi, V., *About Some Temporal Means in Keplerian Motion*, Bul. Inst. Polit. Iasi, L(LIV), 3-4, Sect Mathematics, Theoretical Mechanics, Physics, 2004, pp. 79-92.

Other Conference Papers

1. Condurache, D., Martinusi, V., *A General Method to Study the Motion in A Non-inertial Reference Frame*, 3rd International Conference "Computational Mechanics and Virtual Engineering" COMEC, Brasov, Romania, October 2009.
2. Condurache, D.; Martinusi, V., *Closed Form Solution to the Relative Spacecraft Motion Around a Precessing Planet*, Conferinta Nationala de Mecanica Solidului, Pitesti, 2008.
3. Condurache, D., Martinusi, V., *A Generalized Solution to the Relative Orbital Motion in a Central Force Field*, National Conference "Caius Iacob" of Fluid Mechanics and Technical Applications, Brasov, 2006.
4. Condurache, D., Martinusi, V., *A Quaternionic Procedure in the Study of the Keplerian Relative Orbital Motion*, National Conference "Caius Iacob" of Fluid Mechanics and Technical Applications, Brasov, 2006.
5. Condurache, D., Martinusi, V., *Computing the Field of n^{th} Order Accelerations in Rigid Motion by Direct Measurements*, The 2nd International Conference "Advanced Concepts in Mechanical Engineering", Iasi, 15-17 June, 2006.
6. Condurache, D., Martinusi, V., *A Tensorial Explicit Solution to Darboux Equation*, The 2nd International Conference "Advanced Concepts in Mechanical Engineering", Iasi, 15-17 June, 2006.
7. Condurache, D., Martinusi, V., *A Novel Hypercomplex Solution to Kepler's Problem*, CMDA 2006 – International Workshop on Actual Problems in Celestial Mechanics and Dynamical Astronomy, Babeş-Bolyai University Cluj-Napoca, Romania, 2006.
8. Condurache, D., Martinusi, V., *A Closed Form Vectorial Solution To the Relative Orbital Motion*, CMDA 2006 – International Workshop on Actual Problems in Celestial Mechanics and Dynamical Astronomy, Babeş-Bolyai University Cluj-Napoca, Romania, 2006.
9. Condurache, D., Martinusi, V., *Computing the Logarithm of Homogenous Matrices in $SE(3)$* , 1st International Conference "Computational Mechanics and Virtual Engineering" COMEC, Braşov, 2005.
10. Condurache, D., Martinusi, V., *An Exact Solution to Satellite Relative Orbital Motion*, 1st International Conference "Computational Mechanics and Virtual Engineering" COMEC, Braşov, 2005.
11. Condurache, D., Martinusi, V., *A Vectorial Regularization of the Keplerian Motion*, The 2nd International Symposium of Theoretical and Applied Mechanics "D.I.Mangeron" Conference Proceedings, Bul. Inst. Polit. Iaşi, LI(LIV), 2005.
12. Condurache, D., Martinusi, V., *About the Rectilinear Keplerian Motion*, The 2nd International Symposium of Theoretical and Applied Mechanics "D.I.Mangeron" Conference Proceedings, Bul. Inst. Polit. Iaşi, LI(LIV), 2005.