Curriculum Vitae

PERSONAL INFORMATION

Name	**MASSIMILIANO VASILE**
Address	**VIA RICCIARELLI 12, 20148, MILAN, ITALY**
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Nationality	Italian
Date of birth	23 AUGUST 1970

WORK EXPERIENCE

• Dates (from – to)	**JANUARY 2004 - CURRENT**
• Name and address of employer	Department of Aerospace Engineering, Politecnico di Milano, via La Masa 34, 20156Milano Italy
• Type of business or sector	Education and Research
• Occupation or position held	Lecturer
• Main activities and responsibilities	**Teaching Activities**

Lecturer of Space System Design course. In charge of organizing and delivering the course of Space System Design since January 2004. The course consists of a number of lectures covering all aspects related to the design of a space mission and to the design of all spacecraft subsystems. The course aims at training the students on realistic pre-feasibility studies of possible space missions. As course leader I have to define the objectives and requirements of three different mission scenarios, deliver the related lectures and support the development of the pre-feasibility studies. In this context I am often playing the role of principle investigator or team leader.

In March 2005 I will be delivering, as a visiting professor, the Spacecraft Systems II course to students of the Space Mission Analysis and Design MSc degree at the University of Glasgow. Additional duties include setting the exam paper for the course.

As part of my teaching activities I am currently supervising a number of students working on their final thesis and 2 Ph.D. students.

In 2004 I supervised an Erasmus student, Ross Hilditch, from Glasgow University who worked on the thesis project: *Monographic Optical Docking System*

Research Activities

My research activities are mainly devoted to advanced studies and developments in the fields of mission analysis and design and autonomy for space applications. A more detailed description of my research activities can be found below.

• Dates (from – to)	November 2001- December 2003
• Name and address of employer	ESA/ESTEC, Keplerlaan 1, Postbus 299,2200 AG Noordwijk, The Netherlands
• Type of business or sector	Aerospace Research and Developments
• Occupation or position held	Research Fellow
• Main activities and responsibilities	I was the first member of the Advanced Concepts Team (ACT). My principal duty was to deal with all Mission Analysis and Design issues and research. I had to study and develop advanced tools for mission analysis and design, new methodologies and approaches and produce a document to restructure the way of performing mission analysis in ESA on the basis of what was done in the rest of the world.

In 2002 I organized an international workshop on trajectory optimization and optimization techniques involving a number of specialists from two different fields: pure optimization and space trajectory design.

As a secondary duty I had to support the activities of other ESA sections. I gave support to the

Aurora program for the analysis of launch opportunities to and from Mars, I revised the studies coming from ESOC and participated in the analysis of the trajectories for Mars Exobiology with electric propulsion in collaboration with the propulsion section at ESTEC.

I was involved in the Bepicolombo study (I am still giving support to ESOC for the optimization of advanced trajectories to Mercury).

As part of my duty I had to propose studies in the framework of the ESA General Study Program. I proposed three studies: Advanced Global Optimisation Tools for Mission Analysis and Design, Mime Nature for Hibernation of Astronauts During Long Space Travels, Multidisciplinary Optimisation in Mission Analysis and Design Process.

The first two became later two Ariadna studies awarded respectively to Glasgow University and Reading University the first one and to the University of Verona the second one. The third contract was given to Alenia Spazio in 2003.

In the early stages of the ACT's life I contributed to the definition of the Ariadna program, the research topics and team composition and recruitment philosophy.

In the framework of Ariadna I proposed two studies: Assesment of mission design including utilization of libration points and weak stability boundaries, study on libration points of the sun and the interstellar medium for interstellar travels. The former awarded to the University of Barcellona and to the Politecnico di Milano the latter to Glasgow University and to the University of Padua.

In the period at ESTEC I supervised 5 students working on their master thesis: three of them were from Politecnico di Milano and two of them were from the University of Liegi.

The thesis subjects were:

- 'Optimisation and Design of a Mission to Europa with Solar Electric Propulsion and Multiple Gravity Assist Manoeuvres' (Milan)

- ' Global Design Tools for Preliminary Design of Interplanetary Trajectories' (Milan)

-' A Robust Approach to the Design of Earth-Mars Abort Options' (Milan)

-'Comparison Between Cyclers and Stop-over Cyclers for a Regular Earth-Mars Transportation System'(Liegi)

-'Probabilistic Optimisation Applied to Spacecraft Rendezvous on Keplerian Orbits'(Liegu)

• Dates (from – to)	November 2001- December 2003
• Name and address of employer	Department of Aerospace Engineering, Politecnico di Milano via La Masa 34, 20156Milano Italy
• Type of business or sector	Education and Research
• Occupation or position held	Visiting Professor
• Main activities and responsibilities	Visiting professor forSpace System Design course. During my period at ESTEC I was in charge of organizing and delivering the course lectures of Space System Design from 2001 to 2003.

• Dates (from – to)	January 2000-November 2001
• Name and address of employer	Department of Aerospace Engineering, Politecnico di Milano via La Masa 34, 20156Milano Italy
• Type of business or sector	Education and Research
• Occupation or position held	Technical Project Manager
• Main activities and responsibilities	Thanks to the activity performed during the stage at ESOC, a contract was awarded to the Department of Aerospace Engineering for the development of a software tool for the design of interplanetary and lunar trajectories with low-thrust and multiple gravity assist manoeuvres. The ESA/ESOC contract 14126/00/D/CS was awarded in January 2000 and continued until December 2001. The software was first developed and then tested using three real mission case studies: Bepicolombo, SOLO, SMART-1. I was responsible for all technical aspects of the development and for the practical implementation of the whole software apart from the graphical user interface.

• Dates (from – to)	1998- 2001
• Name and address of employer	Department of Aerospace Engineering, Politecnico di Milano via La Masa 34, 20156Milano Italy
• Type of business or sector	Education and Research
• Occupation or position held	Teaching Assistant
• Main activities and responsibilities	I was in charge of supporting the students during the development of the pre-feasibility study projects and of delivering a number of lectures on specific subjects, such as orbital mechanics and attitude control, for the Space Systems Design course. I also had to set and mark the course exam.

• Dates (from – to)	1996- 1998

• Name and address of employer	Department of Aerospace Engineering, Politecnico di Milano via La Masa 34, 20156Milano Italy
• Type of business or sector	Education and Research
• Occupation or position held	Teaching Assistant
• Main activities and responsibilities	I was in charge of delivering part of the lectures and proposing worked examples and tutorials to students of the Space Flight Mechanics I course.
• Dates (from – to)	1994-2001
• Name and address of employer	Palestra Petrarca, via Petrarca 16 Milano, Italy
• Type of business or sector	Sports
• Occupation or position held	Karate Instructor
• Main activities and responsibilities	The main activity was to teach martial arts to kids (6-12 years old) and to adults, two days a week

EDUCATION AND TRAINING

•Dates (from-to)	November 1998-November 2000
• Name and type of organization providing education and training	Department of Aerospace Engineering, Politecnico di Milano, via La Masa 34, 20156Milano Italy
• Principal subjects/occupational skills covered	The PhD work was mainly focused on trajectory design and optimization with direct techniques. Two basic areas were studied: direct collocation and local NLP sparse solvers, direct multiple shooting and global hybrid evolutionary algorithms. In the framework of the first is the development of the innovative technique of Direct Finite Element Transcription (DFET) which has been applied to the solution of several typical problems in space mission analysis and design. The approach has been extended to the treatment of problems with multiple phases (in parallel or sequential) with one or more objectives. The most challenging problems solved during the PhD were the Bepicolombo, the SOLO and the SMART-1 missions. Hybrid EAs were applied to the solution of Weak Stability Transfers to the Moon. The EAs were hybridized with a local SQP search. The thesis title is: *Optimal Trajectory Design for Interplanetary Spaceflights* The research on DFET has led to the development of the software DITAN under ESA contract. This has required some advanced programming skills in Fortran 77 and Matlab. In parallel with the research on optimization methods for trajectory design, a significant amount of work has been done on strategies and algorithms for autonomy in space. In particular research in this field have been split into three main areas: - autonomy for deep space navigation - autonomy for close approach, rendezvous and landing - autonomy for local mobility
• Title of qualification awarded	PhD in Aerospace Engineering
• Level in national classification (if appropriate)	-
•Dates (from-to)	September 1999-December 1999
• Name and type of organization providing education and training	ESA/ESOC, Robert-Bosch-Str. 5, 64293 Darmstadt Germany
• Principal subjects/occupational skills covered	During this training period (occurred during the PhD course as part of the PhD activities) the main subject was the design of interplanetary trajectories for spacecraft equipped with low-thrust engines. The main case study was the mission LISA. Additional studies were performed on the landing sequence for Bepicolombo.
• Title of qualification awarded	Stage
• Level in national classification (if appropriate)	-
Dates(from-to)	October 1989-October 1996
• Name and type of organization providing education and training	Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133, Milano, Italy

• Principal subjects/occupational skills covered	The Aerospace Engineering Master Degree was a five year course. During the first two years I had basic courses in Mathematics, Physics, Chemistry, Calculus, Numerical Analysis. The last three years I had courses related to Aeronautics and Space topics: Space Flight Mechanics, Space Propulsion, Attitude Control, Orbit Mechanics. The final thesis was on the analysis of stable periodic orbits around the Moon subject to an inhomogeneous gravity field. In particular analytical and numerical solutions for frozen orbit were studied and a method based on finite elements in time were developed for the design of periodic and quasi-periodic solutions. The thesis title was: 'Numerical Approach for the design of Lunar Periodic and Frozen Orbits'. Supervisor Prof. Amalia Finzi
• Title of qualification awarded	Graduation. Master Degree in Aerospace Engineering
• Level in national classification	94/100
•Dates (from-to)	August 1995
• Name and type of organization providing education and training	ESA/ESTEC, , Keplerlaan 1, Postbus 299,2200 AG Noordwijk, The Netherlands
• Principal subjects/occupational skills covered	Winner of the Euroavia European design contest for the design of a small mission to the Moon. 25 students were selected from all over Europe for a 1 month design workshop held at ESTEC. During the workshop we had to design, in a concurrent like fashion, a low-cost mission to the Moon.
• Title of qualification awarded	Design Contest
• Level in national classification (if appropriate)	-
• Dates(from-to)	September 1984-August 1989
• Name and type of organization providing education and training	Collegio San Carlo, Milano, Corso Magenta 71, 20123 Milano, Italy
• Principal subjects/occupational skills covered	High school diploma. The main subject were: - mathematics & physics - chemistry& biology - Latin - Italian literature - history and philosophy - arts
• Title of qualification awarded	Scientific Diploma (Diploma di Maturità Scientifica)
• Level in national classification (if appropriate)	57/60

PERSONAL SKILLS AND COMPETENCES

Acquired in the course of life and career but not necessarily covered by formal certificates and diplomas.

MOTHER TONGUE

ITALIAN

OTHER LANGUAGES

ENGLISH

- Reading skills: EXCELLENT
- Writing skills: GOOD
- Verbal skills: GOOD

SPANISH

- Reading skills: POOR
- Writing skills: POOR
- Verbal skills: POOR

SOCIAL SKILLS AND COMPETENCES

Living and working with other people, in multicultural environments, in positions where communication is important and situations where teamwork is essential (for example culture and sports), etc.

Good attitude toward team work.

The work at the University requires interactions at different levels with students and colleagues. Team work was also essential during my time spent at ESTEC as member of the Advanced Concepts Team.

ORGANISATIONAL SKILLS AND COMPETENCES

Coordination and administration of people, projects and budgets; at work, in voluntary work (for example culture and sports) and at home, etc.

- As part of my work as a lecturer and researcher at Politecnico I have to organize the course of Space System Design and to coordinate the efforts of the students (maximum of 86 so far) during the development of a pre-feasibility study of a space mission.
- At the same time a consistent work of coordination is done for students during their thesis work (both master thesis and PhD). At present I am the supervisor of 6 undergraduate students and 2 PhD students.
- As the first member of the ESA Advanced Concepts Team I had to initiate several activities. In conjunction with two other members we had to initiate the Ariadna program, define its general structure and composition of the team, select new members (both YGT and research fellows), deal with other groups in ESA. In particular I was in charge of the relations with ESCO for what mission analysis was concerned
- During the period at ESTEC I was the technical officer for one industrial contract with Alenia and I was the initiator of three Ariadna contracts.

TECHNICAL SKILLS AND COMPETENCES

With computers, specific kinds of equipment, machinery, etc.

GOOD KNOWLEDGE OF OPERATING SYSTEMS SUCH AS WINDOPWS XP AND LINUX.

GOOD PROGRAMMING SKILLS IN FORTRAN 77 AND MATLAB.

BASIC PROGRAMMING SKILLS IN C++ , FORTRAN 90-95 AND JAVA

ARTISTIC SKILLS AND COMPETENCES

Music, writing, design, etc.

GOOD DRAWING SKILLS AT AMATORIAL LEVEL

REFEREES

RUEDIGER JEHN
MISSION ANALYSIS SECTION
ESA/ESOC , Robert-Bosch-Str. 5, 64293 Darmstadt Germany
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Advanced Concepts Team
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DRIVING LICENCE(S)

Car driving license

ASSOCIATIONS

Since 2001 member of the Italian Association for Operational Research AIRO (Associazione Italiana Ricerca Operativa)

Since 1996 AIAA (American Institute of Aeronautics and Astronautics) member

RESEARCH INTERESTS AND ACTIVITIES

MAJOR AREAS

- **Mission Analysis and Design**
- **Autonomy, Navigation and Control**
- **Optimisation**
- **Biomimetics**

Mission Analysis and Design

- **Orbit and trajectory design**

Several techniques for trajectory design have been studied, developed and applied to orbit design both for GEO and interplanetary missions. Two major groups of software tools have been developed as a consequence of this activity:

- DITAN
- Advanced preliminary tools for mission analysis

The former is a general trajectory design and optimisation tool developed under ESA contract for trajectories characterised by multiple swingbys and electric propulsion. DITAN is an open source software, developed in Fortran77, capable of solving any kind of discrete optimal control problem. At present it is based on the SSQP software SNOPT but a software prototype based on an interior point approach is under development.
The latter is a suite of matlab functions used for preliminary orbit design. The investigation of effective and efficient methods for preliminary mission analysis and design started some three years ago and the set of functions is continuously evolving and enriching with new functionalities. At present, it is possible to design low-thrust-multiple-swingbys trajectories, multigravity assist trajectories with chemical propulsion, multiple aerogravity assist trajectories, HALO orbits, WSB transfers, aerobraking, cyclers, rendezvous and docking manoeuvres.

- **Orbit analysis**

The activities in the field date back to 1996, originally devoted to the analysis of lunar orbits under the effect of gravity perturbations, was then extended to Earth, Mercury and Mars orbits under the effect of gravity and aerodynamic perturbations.

- **System design**

This activity has been carried out mainly throughout the Space System Design course at Politecnico di Milano, used as laboratory for the investigation of standard and advanced mission concepts. A considerable experience has been gathered in recent years working in the ESA Concurrent Design Facility on such missions as BepiColombo, MarsExobiology and the preliminary investigation of a Human Mission to Mars. Further experience has been gathered in the ESA Advanced Concepts Team during the preliminary design of advanced missions to Europa and Pluto.

- **Multidisciplinary design**

Directly linked to trajectory design and system design, multidisciplinary optimisation has been studied in order to improve mission analysis and design. Different methods for MDO (Multidisciplinary Design and Optimisation) have been studied. With particular reference to conflicting multidisciplinary design, in July 2003 a contract was awarded to Alenia Spazio and Politecnico di Torino for the preliminary investigation of a methodology for the robust mission design in case of conflicting situations (either due to non cooperative designers or to dead-end designs).
More recently innovative techniques such as Evidence Theory for treating uncertainty (both epistemic and aleatory) have been used for the multidisciplinary design of aerocapture and reentry vehicles.
Other advanced techniques based on kriging metamodels for costly evaluations are under study in particular for the multidisciplinary design of reusable launch vehicles.

- **Robust design**

Robust design is an interesting technique already in use in other engineering areas such as structural mechanics and that has recently been attarcting interest in space flight mechanics field under the name of desensitised optimal control (DOC). The basic idea is to look for the design point which is robust with respect to the main uncertainties of a typical design process. This technique is expected to provide better results than the traditional margin approach.

Multiagent techniques blended with multiobjective optimisation and game theory have been under study for a while. The experience gathered with the solution of predator-prey dynamics (zero-sum games with conflicting players) and with the first attempt of robust trajectory design applied to missions aiming at the deviation of dangerous NEOs, has been applied to the general mission design problem.
The original idea based on probability theory has been extended to more sophisticated and general techniques for modelling uncertainty such as Evidence Theory.

Autonomy: Navigation and Control

The three main activities in autonomy correspond to a research program initiated some 5 years ago and devoted to autonomous navigation at three different levels: long distance and deep space, medium distance and close approach, short distance and local mobility.

- **Deep space navigation**

So far the activities in this area have been focused on optical systems for orbit determination. A software tool based on an adaptive Kalman filter has been implemented in conjunction with a solar and stellar system simulator (the former based on the JPL ephemeris database DE405, the latter on the hipparcos stellar catalogue), in order to simulated OD in deep space for autonomous probes. An experimental setup, based on CCDs for optical astronomy, is also under construction.

- **Autonomous navigation and control systems for close approach and landing**

An important level of autonomy is related to orbit insertion, landing manoeuvres, rendezvous and docking. The research in this field has focused on motion determination and reconstruction from single camera sequences acquisition using optical flow measurements.

- **Autonomy for local mobility**

The studies in this area led to the construction of a six-wheeled rover capable of autonomous path planning. Position is determined by means of stereo vision based on two cheap web cameras. A simple A* algorithm was used for path planning. More sophisticated ideas both for control and trajectory determination are under study and development. Among them data fusion and some of the techniques studied in biomimetics seem to be particularly promising in order to improve exploration capabilities and robustness in adapting to hostile and unknown environments.
Recently I received an ESA contract for the development of a hybrid deliberative-reactive system for autonomous rovers. The main idea is to combine different techniques for operation planning and scheduling into a three layer system reproducing the basic structure of the human brain (lower layer purely reactive, middle brain instinctive, upper layer sapiens). The main objective is to increase reliability of autonomous planning and decision making in order to have a fault tolerant fault resilient system that minimises the need for FDIR.

Optimisation

- **Advanced techniques for local optimisation**

Besides the use and implementation (embedded in other pieces of software) of known advanced tools for local optimisation (as SNOPT) a considerable effort has been spent in deeply understanding a great variety of techniques for local constrained and unconstrained optimisation both for linear and nonlinear problems. An alternative to SNOPT is under development.

- **Advanced methods for global optimisation**

The use and development of global techniques for trajectory design dates back to 1996, more recently this activity has been extended to general mathematical tools for the global exploration of complex solutions spaces. A considerable experience has been acquired on both stochastic and deterministic approaches ranging from evolutionary algorithms to tunnelling techniques, from branch and bounds methods to interval analysis. The result of these studies is a software package based on a multiagent agent technology blending the main characteristics of evolutionary programming and branching techniques. Other exploration approaches based on stochastic tree growth has been applied to docking manoeuvres and global multiobjective optimisation techniques have been applied to robust design.
On this subject, in the framework of Ariadna, two contracts were(??) awarded in 2004.

Current research aims at the development of robust optimisation systems able to characterise complex problems providing highly reliable and efficient convergence capabilities.

Biomimetics

The activities on biomimetics (or biomimicry or bionics) are the most recent ones and were initiated within the ACT as one of the proposed main and most promising streams of research. In this context a number of studies were awarded in 2004 both in the framework of GSP and of Ariadna.

- **Evolutionary systems and genetics**

Evolutionary systems have been studied as integral part of the research on global optimisation and global exploration methods. Ranging from pure genetic mechanisms (population based evolution or generational adaptation) to swarm behaviour (single or multiple agent adaptation) different biological concepts has been considered.
Besides optimisation and exploration these approaches have been applied to advanced technology generation and verification. This work is still in progress.

- **Single agent and multiple agents systems**

Single agent and multiple agent systems are under study envisaging potential applications to spacecraft control and planning in case of autonomous exploration. Statistical inference and data fusion techniques are under study for potential improvement of agent behaviour and interaction with the environment.
Multiple agent systems have also been investigated for assisted concurrent engineering and for automated information recovery.

ADDITIONAL INFORMATION

in 2003 I was reviewer for the Journal of Spacecrafts and Rockets
In 2004 I was reviewer for the Elsevier Journal of Advances in Space Research

PUBLICATIONS

Books and Refereed Proceedings

1. Vasile M. Bernelli-Zazzera F. *Targeting a Heliocentric Orbit Combining Low-Thrust Propulsion and Gravity Assist Manoeuvres*. Operational Research in Space & Air,vol. 79 ISBN 1-4020-1218-7 Book Series in Applied Optimization Kluwer Academy Press 2003
2. Vasile M. *Combining Evolution Programs and Gradient Methods for WSB Transfer Optimisation*. Operational Research in Space & Air,vol. 79 ISBN 1-4020-1218-7 Book Series in Applied Optimization Kluwer Academy Press 2003
3. Vasile M. *A Systematic-Heuristic Approach for Space Trajectory Design*. Astrodynamics, Space Missions and Chaos, Ann NY Acad Sci 2004 Vol. 1017:234-254
4. Vasile M.,Summerer L.,Linder N.,Saive G. *Advanced Trajectory Options for the Exploration of the Pluto-Charon System*. ISTS 2004-d-49.24th ISTS, May 30,6 June, 2004
5. Summerer L., Vasile M., Ongaro F. *Assessment of an integrated space-terrestrial, solar-based Euro-Asian energy system.*24th ISTS, May 30,6 June, 2004

Journals

1. Vasile M. Bernelli-Zazzera F. *Optimizing Low-Thrust and Gravity Assist Maneuvres to Design Interplanetary Trajectories*. The Journal of the Astronautical Sciences. Vol.51 No. 1 January-March 2003
2. Vasile M., Finzi A.E. *Direct Lunar Descent Optimisation by Finite Elements in Time Approach*. Journal of Mechanics and Control, Vol.01, No. 01,2000
3. Vasile M., Summerer, L., De Pascale, P., *Design of Earth-Mars Transfer Trajectories using evolutionary branching technique*, Acta Astronautica 2005, to appear
4. Summerer L., Ongaro F., Vasile M., Galvez A. *Prospects for Space Power Work in Europe*. Acta Astronautica 53(2003) 571-575
5. Vasile M.,Bottasso C.L.,Finzi A.E. *Lunar Orbital Dynamics by Finite Element in Time Method*. Aerotecnica Missili e Spazio Vol. 75- Numero 3-4 Luglio Dicembre 1996

International Conference Proceedings

1. Finzi A.E., Vasile M. *Numerical Solution for Lunar Orbits*. IAF-97-A.5.08,Proc. of the 48th International Astronautical Congress, Torino, Italy, October 6-10, 1997
2. Floberghagen R., Visser P.,Weischede F.,Vasile M. *On the Analysis of Lunar Albedo Effects on Low Lunar Orbit and Gravity Field Determination*. Proc. of 13th International Symposium on Space Flight Dynamics, Washington D.C.,Vol.1,11-15 May 1998
3. Vasile M., Floberghagen R. *Optimal Trajectories for Lunar Landing Missions*. NASA/CP-1998-206858, Proc. of 13th International Symposium on Space Flight Dynamics, Washington D.C.,Vol.1, pp. 243-257 AAS 98-321, 11-15 May 1998
4. Finzi A. E., Vasile M. *Optimal Attitude Trajectory Manoeuvre for Moon Landing*. Proc. of the 49th IAF congress, Melbourne, Australia, 2-8 October 1998
5. Bernelli-Zazzera F., Finzi A.E.,Romano M., Vasile M. *Preliminary Design of the Microsatellite PalaMede*. International Astronautical Federation Spacialists Symposium on Novel Concepts fro Smaller,Faster & Better Space Missions, Redondo Beach, California, Aprile 1999
6. Goossens S., Floberghagen R., Vasile M. *Long-Term Orbit Predictions for Low-Lunar Satellites Under the Influence of Gravity and Solar Radiation Pressure*. IAF-99-A.4.01 50th International Astronautical Congress 4-8 Oct 1999 Amsterdam, The Netherlands
7. Vasile M.,Romano M. *An Optical Based Strategy for Deep Space Autonomous Navigation*. 4th ESA International Conference on Spacecraft Guidance, Navugation and Control Systems, 18-21 October 1999,ESTEC,Noordwijk, The Netherlands
8. Vasile M., Bernelli Zazzera F., Jehn R., Janin G., *Optimal Interplanetry Trajectories Using a Combination of Low-Thrust and Gravity Assist Manoeuvres.* IAF-00-A.5.07, 51st International Astronautical Congress,2-6 Oct,2000/Rio de

Janeiro, Brazil

9. Vasile M.,Bernelli-Zazzera F. *Combining Low-Thrust and Gravity Assist Manoeuvres to Reach Planet Mercury*. AAS/AIAA Astrodynamics Specialist Conference,30 Jul-2 Aug 2001,Quebec City, Canada
10. Bernelli-Zazzera F.,Ferrario I.,Massari M., Vasile M. *Autonomous Navigation with Stereo Vision System for Interplanetary Exploration*. 52nd International Astronautical Congress, Tolouse France, October 1-5,2001
11. Vasile M.,Bernelli-Zazzera F. *Combining Low-Thrust and Gravity Assist Manoeuvres to Reach Planet Mercury*. AAS/AIAA Astrodynamics Specialist Conference,30 Jul-2 Aug 2001,Quebec City, Canada
12. Vasile M.,Bernelli-Zazzera F. *Orbit Determination by Optical Devices*. ESA Workshop on On-Board Autonomy, ESA WPP-191, Ottobre 2001, pp. 371-378
13. Vasile M., Bernelli-Zazzera F. *Targeting a Heliocentric Orbit Combining Low-Thrust Propulsion and Gravity Assist Manoeuvres*. 16th Space Flight Dynamics Symposium. 3-7 December 2001,Pasadena California,U.S.A
14. Vasile M., Davighi A.,Staffiere G.,Lavagna M. *Autonomous Landing Manoeuvre by Landmark Tracking Technique*. AAS/AIAA Space Flight Mechanics Conference. 27-30 Jauary 2002, San Antonio Texas,U.S.A
15. Vasile M.,Bernelli-Zazzera F. *Direct Multiphase Optimisation of Multiobjective Trajectory Design Problems*. AAS/AIAA Space Flight Mechanics Conference. 27-30 Jauary 2002, San Antonio Texas,U.S.A
16. Vasile M. Bernelli-Zazzera F. *Direct Averaging for Multiple Revolution Trajectory Optimisation*. 2nd International Symposium on Low Thrust Trajectories (LOTUS2), Toulouse 18-20 June 2002
17. Vasile M. Campagnola S., Bernelli-Zazzera F. *Electric Propulsion Options for a Probe to Europa*. 2nd International Symposium on Low Thrust Trajectories (LOTUS2), Toulouse 18-20 June 2002
18. Vasile M. Sironi F., Bernelli-Zazzera F. *Deep Space Autonomous Orbit Determination Using CCD*. AAS/AIAA Astrodynamic Specialist Conference, 5-8 2002 August, Monterey California, U.S.A
19. Vasile M. *Robust Optimization of Trajectory Intercepting Dangerous NEO*. AAS/AIAA Astrodynamic Specialist Conference, 5-8 August 2002, Monterey, California, U.S.A
20. Vasile M. *A Global Optimization Algorithm for Space Trajectory Design*. ICORD 2002 Conference. Anna University. INDIA December 2002
21. Vasile M. *A Systematic-Heuristic Approach for Space Trajectory Design*. New Trends in Astrodynamics and Application, - An international Conference, Washington 20-22 January 2003
22. Vasile M., Biesbroek R., Summerer L., Gálvez A., Kminek G., *Options for a Mission to Pluto and Beyond*. 13th AAS/AIAA Space Flight Mechanics Meeting, Ponce, Puerto Rico, 9-13 February 2003
23. Vasile M. *A Global Approach To Optimal Space Trajectory Design*. AAS-03-141,13 th AAS/AIAA Space Flight Mechanics Meeting, 9-13 February 2003, Puerto Rico
24. Massari M., Bernelli-Zazzera F., Vasile M. *Trajectory Optimization for a Mission to NEOs using Low-Thrust Propulsion and Gravity Assist*. AAS 03-120, 13th AAS/AIAA Space Flight Mechanics Meeting, Ponce, Puerto Rico, 9-13 February 2003
25. Vasile M, Summerer, L., De Pascale, P., *Design of Earth-Mars Transfer Trajectories using evolutionary branching technique*, IAC-03-A.7.07, 54th International Astronautical Congress, 29 September-3 October 2003, Bremen, Germany
26. Vasile M.,Galvez A., Summerer L., Ongaro F. *Design of Low-Thrust Trajectories for the Exploration of the Outer Solar System*. IAC-03-A.P.14. 54th International Astronautical Congress, 29 September-3 October 2003, Bremen, Germany
27. Summerer L., Ongaro F., Vasile M., Galvez A.. *Space and Ground Based Large Scale Solar Power Plants-A European Perspective*. IAC-03-R.1.09. 54th International Astronautical Congress, 29 September-3 October 2003, Bremen, Germany

28. Pessina S.,Campagnola S., Vasile M., *Preliminary Analysis of Interplanetary Trajectory with Aerogravity and Gravity Assist Manoeuvres*. IAC-03-A.P.08, 54th International Astronautical Congress, 29 September-3 October 2003, Bremen, Germany
29. De Pascale P., Vasile M., Finzi A. *A Tool for Preliminary Design of Low Thrust Gravity-Assist Trajectories.* Paper AAS 04-250,14th AAS/AIAA Space Flight Mechanics Conference, 8-12 February 2004, Maui, Hawaii
30. Topputo F.,Vasile M., Finzi A. *An Approach to the Design of Low Energy Interplanetary Transfers Exploiting Invariant Manifolds of the Restricted Three-Body Problem*. Paper AAS 04-245,14th AAS/AIAA Space Flight Mechanics Conference, 8-12 February 2004, Maui, Hawaii
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