# Mauro Massari

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## Education

2005 **Ph.D. in Aerospace Engineering**, *Politecnico di Milano*, Milan, Italy.
Thesis *"Trajectory Optimization for Spacecraft flying in Formation"*

2000 **M.Sc. in Aerospace Engineering**, *Politecnico di Milano*, Milan, Italy.
Thesis *Autonomous navigation of a vehicle for space exploration with stereographic cameras*

## Professional Experiences

2019–present **Associate Professor**, *Politecnico di Milano, Department of Aerospace Science and Technology*, Milan, Italy.
Currently teaching the course of Payload Design.
Delegate for Admission to the M.Sc. in Aeronautical and Space Engineering.
Member of the Scientific Committee of the department.
Member of the PhD Board in Aerospace Engineering.
Member of the Italian delegation to the Inter-Agency Space Debris Coordination Committee (IADC).

2008–2019 **Assistant Professor**, *Politecnico di Milano, Department of Aerospace Science and Technology*, Milan, Italy.

2008–2017 **Co-founder of Dinamica Srl**.

2005–2008 **Post-Doctoral Fellow**, *Politecnico di Milano, Department of Aerospace Science and Technology*, Milan, Italy.
Research topic: *"Methods and techniques for the space qualification of a university microsatellite"*

## Didactic Activity

2015–present Advisor of 5 Ph.D. thesis in Aerospace Engineering at Politecnico di Milano.

2008–present Advisor or Co-Advisor of more than 150 M.Sc. thesis in Space Engineering at Politecnico di Milano.

2016–present Professor of the Payload Design course for the M.Sc. in Space Engineering at Politecnico di Milano.

2011–2015 Professor of the Space Engineering Design Synthesis module in the Space System Design course for the M.Sc. in Space Engineering at Politecnico di Milano.

2012–2015, 2021-2024 Professor of the Introduction to Space Mission Analysis course for the B.Sc. in Aerospace Engineering at Politecnico di Milano.

2009–2011 Professor of the Orbital Mechanics module in the Fundamentals of Flight Mechanics course for the B.Sc. in Aerospace Engineering at Politecnico di Milano.

2008–2009 Professor of the Space System course for the B.Sc. in Aerospace Engineering at Politecnico di Milano.

2003–2008 Teaching Assistant in the Space System Design course for the M.Sc. in Space Engineering at Politecnico di Milano.

## Research Activity

**Trajectory Optimization**

In this Field various aspect has been faced including:

- optimal trajectories for missions to asteroids (NEO) with low-thrust propulsion,
- optimal control problem solution with direct transcription methods,
- optimal control problem solution with a parallel multiple-shooting method associated with an interior point method for the solution of the resulting NLP problem.

**Spacecraft Close Proximity Operations**

In this Field various aspect has been faced including:

- visual navigation techniques for proximity operations
- combined GNC of free-flying space manipulators
- relative pose estimation of uncooperative targets with high order Kalman filters.
- Rendezvous and docking in high elliptical orbits.
- optimization of low thrust reconfiguration maneuvers for formations of satellites in circular and eccentric reference orbit
- station keeping control of formation of satellites with a model predictive controller,
- distributed coordination of reconfiguration maneuvers for swarms of satellites in formation.
- SDRE control of station keeping and reconfiguration maneuvers.

**Space Surveillance and Tracking**

In this Field various aspect has been faced including:

- orbit determination of space debris using multibeam bistatic radar Sensor,
- monitoring of space debris with optical telescopes,
- machine learning methods applied to space object detection in optical telescope images

**Uncertainty Propagation in Astrodynamics**

In this Field various aspect has been faced including:

- development of a software library for Taylor differential algebra (DA),
- uncertainty propagation in orbital dynamics using Taylor differential algebra,
- uncertainty propagation in orbital dynamics using massively parallel Montecarlo simulations on GPGPUs.

## Research Grants

The scientific activity has been performed also under the following research contracts:

### Principal Investigator

- GEORyder - Giving Back Access to the GEO Orbit Through a Reusable Kickstage Vehicle Allowing Transfer from GTO to GEO, Horizon Europe, GA 101135095 for witch the coordinator is Infinite Orbits (Competitive Call HORIZON-CL4-2023-SPACE-01)
- Preparation of Enabling Space Technologies and Building Blocks: "GNC and Robotic Arm Combined Control", ESA Contract No. 4000132611/20/NL/CRS as Subcontractor of University of Padova (Competitive call: ITT)
- Technology for Improving Re-Entry Predictions of European Upper Stages through Dedicated Observations, ESA Contract 4000114349/15/D/SR (Competitive call: ITT)

### Contributor

- EMISSARY: European Military Integrated Space Situational Awareness and Recognition capabilitY, European Commission (Call EDF-2023)
- Software update for the new configuration of BIRALES: Study and development of algorithms for the SST surveillance radar using adaptive beamforming, Italian Institute of Astrophysics
- 'PROOF-OF-CONCEPTS' FOR VLEO SATELLITES FOR DEFENCE OPERATIONS framework contract 23.RTI.OT.122 (EDA)
- ASSA-AI: Autonomous Space-based Situational Awareness and Artificial Intelligence, European Defence Agency (EDA)
- Support to C-SSA/ISOC services and simulation of sensor architectures for SST, Italian Space Agency (ASI)
- Realizzazione di un'Infrastruttura HW e SW (IHS) presso il CGS/Matera, in attuazione del Piano Operativo del sub-investimento M1C2.I4.4 "In-Orbit Economy - SST – FlyEye" del PNRR-FC
- Sviluppo di SW a supporto dei servizi SST per lo studio di detriti spaziali, ASI Contract
- Detriti Spaziali – Supporto alle attività IADC e SST 2019-2021, ASI/INAF Contract
- Mission analysis and relative motion payload design for OneWeb constellation and large constellation active debris removal Phase 0 and Phase A mission design, ESA/OneWeb ARTES Private Public Partnership, subcontractor of D-Orbit
- Support to ISOC Processing software, ASI Contract.
- Studio di fattibilità per la realizzazione di un satellite geosincrono di osservazione della Terra – GEOSAR, ASI Contract
- Supporto alle Attività IADC e Validazione Pre-operativa per SST, ASI/INAF Contract
- Lunar CubeSats for Exploration (LUCE), ESA Contract 4000120225/17/NL/GLC/as (Competitive call: ITT)
- Assessment of onboard DA state estimation for spacecraft relative navigation. ESA Ariadna Contract No. IPL-PTE/LF/as/517.2016
- SpaceSHIP: Space Systems with Hybrid Propulsion, Regione Lombardia, Decree 5744 of 8/7/2015-2016, 2015 (Competitive call)
- Space Shepherd: Saving Human Lives through Satellite Imagery, Politecnico di Milano, 2014-2015 (Competitive call)

- Nonlinear Propagation of Uncertainties in Space Dynamics based on Taylor Differential Algebra, ESA Contract 4000109643/13/NL/MH (Competitive Call: ITT)
- Hybrid Propulsion Transfer Strategies. ESA Contract No. 4000105465/12/NL/AF (Competitive Call: ITT).
- Upgrade of the Uncertainty Propagation Module of STA. ESA Contract No. 4000102634.
- Assessment of Mission Design Including Utilization of Libration Points and Weak Stability Boundaries, ESA Contract 18147/04 (Competitive Call: Ariadna)
- Assessing the Accuracy of Interval Arithmetic Estimates in Space Flight Mechanics. ESA/ACT/Ariadna Contract No. 18851/05/NL/MV (Competitive Call: Ariadna)
- An Advanced Intelligent, Fault-tolerant System for Autonomy in Risky Environments. ESA Contract No. 18693/04/NL/MV (Competitive Call: ITI)
- Upgrade of Direct Interplanetary Trajectory Analysis Software (DITAN-2). ESA Contract, Subcontractor of Aurora B.V
- SIMONE: a NEO Space Mission Preparation Study. Subcontractor of QuinetiQ.

# Publications

## Peer-Reviewed International Journal


[1] A. Muciaccia, L. Facchini, M. F. Montaruli, G. Purpura, R. Detomaso, C. Colombo, M. Massari, P. Di Lizia, A. Di Cecco, L. Salotti, and G. Bianchi. Radar observation and recontruction of cosmos 1408 fragmentation. *JOURNAL OF SPACE SAFETY ENGINEERING*, 11(1):143–149, 2024.

[2] Marco Felice Montaruli, Giovanni Purpura, Riccardo Cipollone, Andrea De Vittori, Luca Facchini, Pierluigi Di Lizia, Mauro Massari, Moreno Peroni, Alessandro Panico, Andrea Cecchini, and Marco Rigamonti. An orbit determination software suite for space surveillance and tracking applications. *CEAS SPACE JOURNAL*, 16(5):619–633, 2024.

[3] Marco Felice Montaruli, Maria Alessandra De Luca, Mauro Massari, Germano Bianchi, and Alessio Magro. Operational angular track reconstruction in space surveillance radars through an adaptive beamforming approach. *AEROSPACE*, 11(6):1–24, 2024.

[4] Federico Basana, Zeno Pavanello, Francesco Branz, Alessandro Francesconi, Giacomo Borelli, Davide Invernizzi, Mauro Massari, Marco Lovera, Alessia Nocerino, Roberto Opromolla, Irene Huertas Garcia, and Pedro Simplicio. Satellite and robotic arm combined control for spacecraft close-proximity operations. *CEAS SPACE JOURNAL*, [online 2024]:1–27, 2024.

[5] F. Topputo, G. Merisio, V. Franzese, C. Giordano, M. Massari, G. Pilato, D. Labate, A. Cervone, S. Speretta, A. Menicucci, E. Turan, E. Bertels, J. Vennekens, R. Walker, and D. Koschny. Meteoroids detection with the lumio lunar cubesat. *ICARUS*, 389:1–19, 2023.

[6] A. Scorsoglio, R. Furfaro, R. Linares, and M. Massari. Relative motion guidance for near-rectilinear lunar orbits with path constraints via actor-critic reinforcement learning. *ADVANCES IN SPACE RESEARCH*, 71(1):316–335, 2023.

[7] A. Cervone, F. Topputo, S. Speretta, A. Menicucci, E. Turan, P. Di Lizia, M. Massari, V. Franzese, C. Giordano, G. Merisio, D. Labate, G. Pilato, E. Costa, E. Bertels, A. Thorvaldsen, A. Kukharenka, J. Vennekens, and R. Walker. Lumio: A cubesat for observing and characterizing micro-meteoroid impacts on the lunar far side. *ACTA ASTRONAUTICA*, 195:309–317, 2022.

[8] M. F. Montaruli, L. Facchini, P. Di Lizia, M. Massari, G. Pupillo, G. Bianchi, and G. Naldi. Adaptive track estimation on a radar array system for space surveillance. *ACTA ASTRONAUTICA*, 198:111–123, 2022.

[9] A. De Vittori, R. Cipollone, P. Di Lizia, and M. Massari. Real-time space object tracklet extraction from telescope survey images with machine learning. *ASTRODYNAMICS*, 6(2):205–218, 2022.

[10] Simone Servadio, Francesco Cavenago, Pierluigi Di Lizia, and Mauro Massari. Nonlinear prediction in marker-based spacecraft pose estimation with polynomial transition maps. *JOURNAL OF SPACECRAFT AND ROCKETS*, 59(2):511–523, 2022.

[11] Francesco Cavenago, Alessandro M. Giordano, and Mauro Massari. Contact detection, isolation and estimation for orbital robots through an observer based on a centroid-joints dynamics. *ACTA ASTRONAUTICA*, 181:40–51, 2021.

[12] Francesco Cavenago, Mauro Massari, Alessandro M. Giordano, and Gianluca Garofalo. Unexpected collision detection, estimation, and reaction for a free-flying orbital robot. *JOURNAL OF GUIDANCE CONTROL AND DYNAMICS*, 44(5):967–982, 2021.

[13] R. Furfaro, A. Scorsoglio, R. Linares, and M. Massari. Adaptive generalized zem-zev feedback guidance for planetary landing via a deep reinforcement learning approach. *ACTA ASTRONAUTICA*, 171:156–171, 2020.

[14] D. Cutajar, A. Magro, J. Borg, K. Z. Adami, G. Bianchi, G. Pupillo, A. Mattana, G. Naldi, C. Bortolotti, F. Perini, L. Lama, M. Schiaffino, M. Roma, A. Maccaferri, P. Di Lizia, M. Massari, and M. Losacco. Pybirales: A radar data processing backend for the real-time detection of space debris. *JOURNAL OF ASTRONOMICAL INSTRUMENTATION*, 9:1–14, 2020.

[15] M. Losacco, P. Di Lizia, M. Massari, G. Naldi, G. Pupillo, G. Bianchi, and J. Siminski. Initial orbit determination with the multibeam radar sensor birales. *ACTA ASTRONAUTICA*, 167:374–390, 2020.

[16] D. Cutajar, A. Magro, J. Borg, K. Zarb Adami, G. Bianchi, C. Bortolotti, A. Cattani, F. Fiocchi, L. Lama, A. Maccaferri, A. Mattana, M. Morsiani, G. Naldi, F. Perini, G. Pupillo, M. Roma, S. Rusticelli, M. Schiaffino, P. Di Lizia, M. Losacco, M. Massari, M. Reali, and W. Villadei. A real-time space debris detection system for birales. *JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY*, 72:102–108, 2019.

[17] Francesco Cavenago, Pierluigi Di Lizia, Mauro Massari, and Alexander Wittig. On-board spacecraft relative pose estimation with high-order extended kalman filter. *ACTA ASTRONAUTICA*, 158:55–67, 2019.

[18] Francesco Cavenago, Lorenzo Voli, and Mauro Massari. Adaptive hybrid system framework for unified impedance and admittance control. *JOURNAL OF INTELLIGENT & ROBOTIC SYSTEMS*, 91:569–581, 2018.

[19] Paolo Massioni and Mauro Massari. Convex optimisation approach to constrained fuel optimal control of spacecraft in close relative motion. *ADVANCES IN SPACE RESEARCH*, 61:2366–2376, 2018.

[20] Mauro Massari, Pierluigi Di Lizia, and Mirco Rasotto. Nonlinear uncertainty propagation in astrodynamics using differential algebra and graphics processing units. *JOURNAL OF AEROSPACE INFORMATION SYSTEMS*, 14:493–503, 2017.

[21] M. Massari and A. Wittig. Optimization of multiple-rendezvous low-thrust missions on general-purpose graphics processing units. *JOURNAL OF AEROSPACE INFORMATION SYSTEMS*, 13:80–92, 2016.

[22] A. G. Castiglioni, M. B. Bigdeli, C. Palamini, D. Martinoia, L. Frezza, B. Matassini, D. Pizzocri, and M. Massari. Spaceship earth. space-driven technologies and systems for sustainability on ground. *ACTA ASTRONAUTICA*, 115:195–205, 2015.

[23] Mauro Massari and M. Zamaro. Application of sdre technique to orbital and attitude control of spacecraft formation flying. *ACTA ASTRONAUTICA*, 94:409–420, 2014.

[24] M. Massari, F. Bernelli Zazzera, and S. Canavesi. Nonlinear control of formation flying with state constraints. *JOURNAL OF GUIDANCE CONTROL AND DYNAMICS*, 35:1919–1925, 2012.

[25] M. Massari and F. Bernelli Zazzera. Optimization of low-thrust reconfiguration maneuvers for spacecraft flying in formation. *JOURNAL OF GUIDANCE CONTROL AND DYNAMICS*, 32:1629–1638, 2009.

[26] M. Ceriotti, M. Vasile, G. Giardini, and M. Massari. Approach to model interest for a planetary rover through dezert-smarandache theory. *JOURNAL OF AEROSPACE COMPUTING, INFORMATION, AND COMMUNICATION*, 6:92–108, 2009.

[27] M. Massari, G. Sangiovanni, and F. Bernelli Zazzera. N.e.me.sys: a planetary legged rover controlled with dynamical artificial neural networks. *INTELLIGENT AUTOMATION AND SOFT COMPUTING*, 14:263–278, 2008.

[28] M. Massari. Optimization of relative orbit transfer with low thrust propulsion. *INTERNATIONAL JOURNAL OF MECHANICS AND CONTROL*, 8:9–22, 2007.

### Book Chapters

[29] Giuseppe Di Mauro, Dario Spiller, and Mauro Massari. *Control architectures and algorithms*, pages 257–306. Elsevier, 2023.

[30] S. Speretta, A. Cervone, P. Sundaramoorthy, R. Noomen, S. Mestry, A. Cipriano, F. Topputo, J. Biggs, P. Di Lizia, M. Massari, K. Mani, D. Dei Tos, S. Ceccherini, V. Franzese, A. Ivanov, D. Labate, L. Tommasi, A. Jochemsen, J. Gailis, R. Furfaro, V. Reddy, J. Vennekens, and R. Walker. *LUMIO: an Autonomous CubeSat for Lunar Exploration*, pages 103–134. Springer, Cham, 2019.

[31] Topputo Francesco and Massari Mauro. *Modeling and Optimization of Hybrid Transfers to Near-Earth Objects*, pages 425–442. Springer, 2016.

### International Conferences

[32] N. Faraco, M. Maestrini, M. Massari, and P. Di Lizia. Multiview optical navigation for space manipulator systems during in-orbit servicing missions. In *2024 AAS/AIAA Astrodynamics Specialist Conference*, pages 1–16, 2024.

[33] Luca Capocchiano, Michele Maestrini, Mauro Massari, and Pierluigi DI LIZIA. Onboard autonomous conjunction analysis with optical sensor. In *Aeronautics and Astronautics AIDAA XXVII International Congress*, volume 37, pages 526–529. Materials Research Forum, 2023.

[34] D. Invernizzi, P. Ghignoni, L. Ticozzi, M. Massari, M. Lovera, P. Simplicio, and I. Huertas Garcia. Robust control of free-flying space manipulator for capturing uncontrolled

tumbling objects. In *12th International Conference on Guidance, Navigation Control Systems (GNC) and 9th International Conference on Astrodynamics Tools and Techniques (ICATT)*, pages 1–15, 2023.

[35] M. F. Montaruli, M. A. De Luca, P. Di Lizia, M. Massari, S. Tebaldini, G. Bianchi, G. Pupillo, G. Naldi, D. Cutajar, A. Magro, and K. Zarb Adami. Operational application of an adaptive beamforming approach for angular track estimation in survey radars. In *2nd International Orbital Debris Conference (IOC II)*, pages 1–10, 2023.

[36] A. Muciaccia, L. Facchini, M. F. Montaruli, G. Purpura, R. Detomaso, C. Colombo, M. Massari, P. Di Lizia, A. Di Cecco, L. Salotti, and G. Bianchi. Observation and analysis of cosmos 1408 fragmentation. In *73rd International Astronautical Congress (IAC 2022)*, pages 1–7, 2022.

[37] M. F. Montaruli, P. Di Lizia, L. Facchini, M. Massari, G. Pupillo, G. Naldi, and G. Bianchi. Adaptive angular track estimation for resident space object orbit determination. In *44th COSPAR Scientific Assembly 2022*, 2022.

[38] M. Gallucci, M. Massari, R. Cipollone, A. De Vittori, and G. Purpura. Light curve inversion for attitude reconstruction of tumbling space debris. In *73rd International Astronautical Congress (IAC 2022)*, pages 1–8. International Astronautical Federation, IAF, 2022.

[39] S. Speretta, E. Turan, A. Cervone, A. Menicucci, F. Topputo, V. Franzese, C. Giordano, G. Merisio, P. Di Lizia, M. Massari, D. Labate, A. Taiti, G. Pilato, E. Bertels, A. Paskeviciute, K. Woroniak, D. Koschny, J. Vennekens, and R. Walker. Lumio: A cubesat to monitor micro-meteroid impacts on the lunar farside. In *2022 IEEE Aerospace Conference*, pages 1–8. IEEE, 2022.

[40] M. F. Montaruli, L. Facchini, P. Di Lizia, M. Massari, G. Pupillo, G. Naldi, and G. Bianchi. An adaptive approach for the angular track estimation of resident space objects through surveillance radar system. In *6th European Workshop on Space Debris Modeling and Remediation*, pages 1–24, 2022.

[41] G. Purpura, A. De Vittori, R. Cipollone, L. Facchini, P. Di Lizia, M. Massari, A. Di Cecco, and L. Salotti. Ga-based optimal tasking for sst sensor networks in the sensit tool. In *73rd International Astronautical Congress (IAC 2022)*, pages 1–10. International Astronautical Federation, IAF, 2022.

[42] M. F. Montaruli, G. Purpura, R. Cipollone, A. De Vittori, L. Facchini, P. Di Lizia, M. Massari, M. Peroni, A. Panico, A. Cecchini, and M. Rigamonti. A software suite for orbit determination in space surveillance and tracking applications. In *9th European Conference for Aerospace Sciences (EUCASS 2022)*, pages 1–12, 2022.

[43] R. Cipollone, M. F. Montaruli, N. Faraco, P. Di Lizia, M. Massari, A. De Vittori, M. Peroni, A. Panico, and A. Cecchini. A re-entry analysis software module for space surveillance and tracking operations. In *73rd International Astronautical Congress (IAC 2022)*, pages 1–7, 2022.

[44] N. Faraco, G. Purpura, P. Di Lizia, M. Massari, M. Peroni, A. Panico, A. Cecchini, and F. Del Prete. Snos: Automatic optimal observations scheduling for sensor networks. In *9th European Conference for Aerospace Sciences (EUCASS 2022)*, pages 1–11, 2022.

[45] G. Purpura, A. De Vittori, R. Cipollone, P. Di Lizia, M. Massari, C. Colombo, A. Di Cecco, and L. Salotti. Sensit: a software suite for observation scheduling and performance assessment of sst sensor networks. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–13, 2021.

[46] A. Cervone, F. Topputo, S. Speretta, A. Menicucci, P. Di Lizia, M. Massari, V. Franzese, C. Giordano, G. Merisio, D. Labate, G. Pilato, E. Costa, E. Bertels, A. Thorvaldsen, A. Kukharenka, J. Vennekens, and R. Walker. Design challenges and opportunities offered by the lumio spacecraft: a cubesat for observing and characterizing micro-meteoroid impacts on the lunar far side. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–11, 2021.

[47] F. Topputo, G. Merisio, C. Giordano, V. Franzese, M. Massari, P. Di Lizia, D. Labate, G. Pilato, A. Cervone, S. Speretta, A. Menicucci, E. Bertels, A. Thorvaldsen, A. Kukharenka, J. Vennekens, and R. Walker. Current status of lumio mission: Characterizing lunar meteoroid impacts with a cubesat. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–11, 2021.

[48] L. Ticozzi, G. Corinaldesi, M. Massari, F. Cavenago, M. King-Smith, and P. Tsiotras. Coordinated control of spacecraft-manipulator with singularity avoidance using dual quaternions. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–14, 2021.

[49] Z. Pavanello, F. Branz, A. Francesconi, A. Cenedese, R. Antonello, F. Basana, P. Iob, D. Vertuani, M. Massari, C. Colombo, M. Lovera, D. Invernizzi, P. Ghignoni, L. Ticozzi, G. Borelli, R. Opromolla, M. Grassi, G. Fasano, A. Nocerino, C. Lombardi, C. Vela, I. Huertas Garcia, and P. Simplicio. Combined control and navigation approach to the robotic capture of space vehicles. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–13, 2021.

[50] M. F. Montaruli, L. Facchini, P. Di Lizia, M. Massari, G. Pupillo, G. Naldi, and G. Bianchi. Resident space object orbit determination using a multireceiver radar system. In *72nd International Astronautical Congress (IAC 2021)*, pages 1–7, 2021.

[51] R. Cipollone, A. De Vittori, P. Di Lizia, M. Massari, M. F. Montaruli, G. Bianchi, G. Pupillo, and G. Naldi. Multilayer perceptron neural network for leo track reconstruction from multibeam radar measurements. In *26th Conference of the Italian Association of Aeronautics and Astronautics (AIDAA 2021)*, pages 1–7, 2021.

[52] L. Facchini, M. F. Montaruli, P. Di Lizia, M. Massari, G. Pupillo, G. Naldi, and G. Bianchi. Resident space object track reconstruction using a multireceiver radar system. In *8th European Conference on Space Debris, ESA/ESOC*, pages 1–8. ESA, 2021.

[53] C. Colombo, S. Huang, G. Borelli, F. Cavenago, M. Nugnes, J. L. Gonzalo Gòmez, G. Gaias, M. Massari, L. Vallini, M. Petit, P. Guerrieri, M. Valli, and S. Antonetti. Mission analysis and design for an active debris removal service for large constellations. In *8th European Conference on Space Debris, ESA/ESOC*, pages 1–11. ESA, 2021.

[54] G. Purpura, A. De Vittori, R. Cipollone, M. Massari, C. Colombo, P. Di Lizia, S. Cicalò, F. Guerra, A. Bertolucci, A. Di Cecco, and L. Salotti. Development of a software suite for performance assessment of sst sensor networks. In *8th European Conference on Space Debris, ESA/ESOC*, pages 1–12. ESA, 2021.

[55] G. Borelli, M. Trisolini, M. Massari, and C. Colombo. A comprehensive ranking framework for active debris removal missions candidates. In *8th European Conference on Space Debris, ESA/ESOC*, pages 1–10. ESA, 2021.

[56] F. Topputo, G. Merisio, C. Giordano, V. Franzese, M. Massari, J. Biggs, P. Di Lizia, D. Labate, G. Pilato, A. Taiti, E. Bertels, K. Woroniak, A. Cervone, S. Speretta, A. Menicucci, A. Thorvaldsen, A. Kukharenka, D. Koschny, J. Vennekens, and R. Walker.

Lumio cubesat: a mission to refine meteoroid population knowledge. In *7th IAA Planetary Defense Conference (PDC 2021)*, pages 1–3, 2021.

[57] G. Bianchi, C. Bortolotti, M. Roma, G. Pupillo, G. Naldi, L. Lama, F. Perini, M. Schiaffino, A. Maccaferri, A. Mattana, A. Podda, S. Casu, F. Protopapa, A. Coppola, P. Di Lizia, G. Purpura, M. Massari, M. F. Montaruli, T. Pisanu, L. Schirru, and E. Urru. Exploration of an innovative ranging method for bi-static radar, applied in leo space debris surveying. In *71st International Astronautical Congress (IAC 2020)*, pages 1–6, 2020.

[58] A. Podda, S. Casu, A. Coppola, F. Protopapa, A. L. Sergiusti, T. Pisanu, E. Urru, L. Schirru, P. Ortu, F. Gaudiomonte, G. Bianchi, C. Bortolotti, M. Roma, G. Pupillo, L. Lama, F. Perini, M. Schiaffino, A. Maccaferri, G. Naldi, A. Mattana, P. Di Lizia, G. Purpura, and M. Massari. Exploitation of bi-static radar architectures for leo space debris surveying and tracking: The birales/blralet project. In *2020 IEEE Radar Conference (RadarConf20)*, pages 1–6. IEEE, 2020.

[59] A. De Vittori, R. Cipollone, P. Di Lizia, and M. Massari. Real time space object tracklet extraction from telescope survey images with machine learning. In *71st International Astronautical Congress (IAC 2020)*, pages 1–9, 2020.

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