Davide Amato - Curriculum Vitae

Contact

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Current position

Department of Aeronautics, ***Imperial College London****, London, UK.* 2021–pres.
Lecturer in Spacecraft Engineering.

Research interests: **astrodynamics**; special perturbations, uncertainty quantification, applications to space domain awareness; machine learning for dynamical systems; planetary entry, descent, and landing; spacecraft guidance, navigation, and control.

Teaching:
- AERO70016/97079 Orbital Mechanics
- AERO70019/96022 Spacecraft Systems
- Positive student feedback evidenced by 2021/22 module evaluation questionnaires.

Mentoring:
- Providing personal tutoring to 11 undergraduate students.
- Led a student team in the 11th Global Trajectory Optimization Competition, organized by ESA (October 2021).

Service:
- Internal examiner for 3 PhD students.
- Coordination of the *Space Engineering group* of 9 academics in space-related disciplines at the Department of Aeronautics, involving outreach coordination and liaising with UK Space Agency.
- Organiser of the Imperial College London Space Engineering seminar series.
- Contributed to the Department of Aeronautics and Faculty of Engineering research vision.
- Panel member for staff equipment bids.
- Participation in and organization of events in collaboration with the ICSS (Imperial College Space Society) student society.

Outreach: gave interviews on space missions to Newsweek (Sep 2021), Voice of Islam (radio station, Oct 2022). Interview invitee for BBC World Service Newshour (Apr 2023).

Past positions

Aerospace Engineering Sciences, ***University of Colorado Boulder****, Boulder, CO, USA.* 2019–2020
Postdoctoral Associate (J-1 Research Scholar).

Research project: Robust Entry and Landing Guidance under Dynamic Uncertainty (NASA ECF grant, PI: Prof Jay McMahon).

Aerospace & Mechanical Engineering, ***The University of Arizona****, Tucson, AZ, USA.* 2019–2020
Postdoctoral Research Associate (J-1 Research Scholar).

Research project: Fast Integrations in Computational Astrodynamics.

School of Aerospace Engineering, ***Technical University of Madrid****, Madrid, Spain.* 2013–2016
Marie Curie Early Stage Researcher within the *Stardust* FP7 Initial Training Network.

Research visits

Department of Physics, ***Aristotle University of Thessaloniki****, Thessaloniki, Greece* 2017
- Visiting researcher in the Section of Astrophysics, Astronomy, and Mechanics.
- Research Topic: *Numerical Exploration of Chaotic Dynamics in MEO and GEO*.

Institute of Applied Physics, ***National Research Council****, Firenze, Italy* 2015
- Visiting researcher under the “Stardust” European Commission FP7 project.
- Research topic: *Comparison of Orbit Propagation Methods for Earth Satellite Orbits*.

Department of Mathematics, ***University of Pisa****, Pisa, Italy* 2015
- Visiting researcher under the “Stardust” European Commission FP7 project.
- Research topic: *Propagation of Asteroid Close Encounters through Regularized Equations*.

Education

Technical University of Madrid*, Madrid, Spain.* 2013–2017
Ph.D. in Aerospace Engineering, *cum laude*, international doctorate.

Thesis: Advanced Orbit Propagation Methods applied to Asteroids and Space Debris.

***University of Naples "Federico II"**, Naples, Italy.* 2010–2013
M.Sc. (*Laurea Magistrale*) in Aerospace Engineering, 110/110 *cum laude*.

***University of Naples "Federico II"**, Naples, Italy.* 2006–2009
B.Sc. (*Laurea Triennale*) in Aerospace Engineering, 110/110.

Professional Activity

- Member of the American Astronautical Society (AAS), American Institute of Aeronautics and Astronautics (AIAA).
- Reviewer for The Journal of Astronautical Sciences (*6 reviews*), Journal of Guidance, Control, and Dynamics (*nominated as excellent reviewer for 2020, 2021*), Journal of Spacecraft and Rockets, Advances in Space Research, Data-Centric Engineering, MDPI Aerospace, Astrophysics & Space Science, AIAA SciTech 2022-23, AviaSpace 2020, IEEE Metrology conference, Elsevier Science & Technology books.
- Chaired sessions at the *33rd AAS/AIAA Spaceflight Mechanics Meeting* (January 2023), *Stardust-R Global Virtual Workshop II* (September 2021), *2021 AAS/AIAA Astrodynamics Specialist Conference* (August 2021).
- Invited external examiner for the PhD vivas of Dr Rasit Abay (University of New South Wales, Canberra, Australia), Dr Merel Vergaaij (University of Glasgow, UK), Xiaoyu Fu (Surrey University).

Student supervision

PhD students

Experience in supervising **10 PhD students**.

- Currently supervising Max Hallgarten La Casta (exp. graduation 2025, Imperial College London).
- Currently supervising Nicola Cimmino (visiting student, University of Naples "Federico II"), April to September 2023.
- Supervised Yirui Wang (visiting student, University of Strathclyde), June to August 2022.
- Co-supervised 7 PhD students at the University of Colorado Boulder (2019–20): Dahlia Baker, Spencer Boone, Taralicin Deka, Matt Givens, Melis J. Grace, Shayna Hume, Chloe Long.

Master's students

Experience in supervising **25 Master's students**.

- Currently supervising 2 Individual Projects: Ali Khabibulayev, Sabin-Anton Viorel (expected graduation 2023).
- Supervised 12 Final Year and Individual Projects:
  - Irene Saiz Briones, You Min Li, Dannielle Lee (AY 2022/23, Imperial College London)
  - Madalina-Cristina Bivolaru, Sui Chen, Owen O'Keeffe, Thiago Schnaider Fridman Ferreira Pinto, Tim van Den Wyngaert, Haoran Xu, Ziyu Zhao (AY 2021/22, Imperial College London)
  - Isaias Andom Araya, Vlad Marascu (AY 2020/21, Imperial College London)
- Currently supervising 3 summer research projects: Nihal Simha, Nicole Chan (visiting MIT AeroAstro student), Owen Brooke (co-supervised with Dr Urban Fasel).
- Supervised 3 summer research projects:
  - Usman Raihaan, Yaqoob Usmaan (AY 2021/22)
  - Francesca Covella (AY 2020/21)
- Co-supervised 5 Final Year Project and Master's students:
  - Daniele Bella, Vincenzo Schiavo (AY 2021/22, Imperial College London)
  - Hunter Mellema (AY 2018/19, University of Colorado Boulder)
  - Hossein Namazyfard, Nathan Reiland (AY 2018/19, The University of Arizona)

Research projects

UKSA National Space Technology Programme - Space Surveillance and Tracking call 2021-22

- Project AI4SST (Artificial Intelligence for Space Surveillance and Tracking), aimed at advancing an artificial intelligence framework for Space Surveillance and Tracking, and Space Traffic Management. Project ran from November 2021 to March 2022.
- Total amount: £153 088, of which £42 206 was allocated to Imperial.
- PI: Massimiliano Vasile (University of Strathclyde); Co-Is: **Davide Amato** (Imperial College London), Carmine Clemente (University of Strathclyde), Portia Bowman (D-Orbit UK).

Marie Skłodowska-Curie Individual Fellowship 2018

- Project "Mission Concepts for High-Performance CubeSat Platforms with Propulsion System" in the European Commission Horizon 2020 programme, total value €159 461.
- Host organisation: SpaceEye GmbH, Berlin, Germany.

Publications

Journal articles (8)

[1] J. A. Rataczak, **D. Amato**, and J. W. McMahon. *Density Estimation for Entry Guidance Problems using Deep Learning*. Submitted to the Journal of Guidance, Control, and Dynamics. 2023.

[2] N. Cho, H.-S. Shin, A. Tsourdos, and **D. Amato**. *Incremental Correction in Dynamic Systems Modelled with Neural Networks for Constraint Satisfaction*. Under review for the Journal of Guidance, Control, and Dynamics. 2022. arXiv: 2209.03698 [cs, eess, math].

[3] **D. Amato** and J. W. McMahon. "Deep Learning Method for Martian Atmosphere Reconstruction". In: *Journal of Aerospace Information Systems* (2021), pp. 1–11. DOI: 10.2514/1.I010922.

[4] C. Bombardelli, G. Falco, **D. Amato**, and A. J. Rosengren. "Space Occupancy in Low-Earth Orbit". In: *Journal of Guidance, Control, and Dynamics* (2021), pp. 1–17. DOI: 10.2514/1.G005371.

[5] **D. Amato**, R. Malhotra, V. Sidorenko, and A. J. Rosengren. "Lunar Close Encounters Compete with the Circumterrestrial Lidov–Kozai Effect". In: *Celestial Mechanics and Dynamical Astronomy* 132.6 (2020), p. 35. DOI: 10.1007/s10569-020-09972-6.

[6] **D. Amato**, C. Bombardelli, G. Baù, V. Morand, and A. J. Rosengren. "Non-Averaged Regularized Formulations as an Alternative to Semi-Analytical Orbit Propagation Methods". In: *Celestial Mechanics and Dynamical Astronomy* 131.5 (2019), p. 21. DOI: 10.1007/s10569-019-9897-1.

[7] **D. Amato**, G. Baù, and C. Bombardelli. "Accurate Orbit Propagation in the Presence of Planetary Close Encounters". In: *Monthly Notices of the Royal Astronomical Society* 470.2 (2017), pp. 2079–2099. DOI: 10.1093/mnras/stx1254.

[8] C. Bombardelli, **D. Amato**, and J. L. Cano. "Mission Analysis for the Ion Beam Deflection of Fictitious Asteroid 2015 PDC". In: *Acta Astronautica* 118 (2016), pp. 296–307. DOI: 10.1016/j.actaastro.2015.11.003.

Book chapters (2)

[9] **D. Amato** and C. Bombardelli. "Advanced Orbit Propagation Methods and Application to Space Debris Collision Avoidance". In: *Asteroid and Space Debris Manipulation: Advances from the Stardust Research Network*. Ed. by M. Vasile and E. Minisci. Reston ,VA: American Institute of Aeronautics and Astronautics, Inc., 2016. DOI: 10.2514/4.103247.

[10] J. L. Cano and **D. Amato**. "Orbital Dynamics About Small Bodies". In: *Asteroid and Space Debris Manipulation: Advances from the Stardust Research Network*. Ed. by M. Vasile and E. Minisci. Reston ,VA: American Institute of Aeronautics and Astronautics, Inc., 2016. DOI: 10.2514/4.103247.

Conference proceedings (20)

[11] S. Chen and **D. Amato**. "Dynamical Characterization of Endogenous Conjunctions within the Starlink Constellation". In: *33rd AAS/AIAA Space Flight Mechanics Meeting*. Austin, TX, United States. 2023.

[12] C. D. Enríquez and **D. Amato**. "Application of LSTMs to the Light Curve Inversion Problem". In: 33rd AAS/AIAA Space Flight Mechanics Meeting. Austin, TX, United States, 2023.

[13] I. A. Araya and **D. Amato**. "Spectral Analysis of US Space Catalog Ephemerides for LAGEOS-1". In: AIAA SCITECH 2022 Forum. San Diego, CA, USA: American Institute of Aeronautics and Astronautics, 2022. DOI: 10.2514/6.2022-1772.

[14] M. I. Hallgarten La Casta, **D. Amato**, and M. Vasile. "Polynomial Algebra for Uncertainty Propagation in Generalised Equinoctial Orbital Elements". In: 73rd International Astronautical Congress (IAC). Paris, France: International Astronautical Federation, 2022.

[15] J. W. McMahon, **D. Amato**, D. Kuettel, and M. J. Grace. "Stochastic Predictor-Corrector Guidance". In: AIAA SCITECH 2022 Forum. San Diego, CA, USA: American Institute of Aeronautics and Astronautics, 2022. DOI: 10.2514/6.2022-1771.

[16] O. Fuentes-Muñoz, A. Pedros-Faura, and **D. Amato**. “Effect of Non-Keplerian MOID Evolution on Preliminary Keyhole Analyses”. In: 7th IAA Planetary Defense Conference. Vienna, Austria, 2021.

[17] **D. Amato**, S. Hume, B. Grace, and J. McMahon. “Robustifying Mars Descent Guidance through Neural Networks”. In: AAS Guidance, Navigation, and Control Conference. Breckenridge, CO, United States, 2020.

[18] **D. Amato**, S. Hume, M. J. Grace, E. Roelke, and J. W. McMahon. “Mars EDL and Aerocapture Guidance under Dynamic Uncertainty”. In: *Advances in the Astronautical Sciences*. 2020 AAS/AIAA Astrodynamics Specialist Conference. Vol. 175. Virtual, 2020.

[19] **D. Amato**, C. Bombardelli, L. Dell’Elce, H. Namazyfard, and A. J. Rosengren. “Recovering the Chaotic Orbit of Cosmos 862”. In: Key Topics in Orbit Propagation (KePASSA) Workshop. Logroño, Spain, 2019.

[20] A. J. Rosengren, **D. Amato**, C. Bombardelli, and M. K. Jah. “Resident Space Object Proper Orbital Elements”. In: *Advances in the Astronautical Sciences*. 29th AAS/AIAA Space Flight Mechanics Meeting. Vol. 168. Maui, Hawaii, USA, 2019.

[21] D. Amato, **R. Furfaro**, A. J. Rosengren, and M. Maadani. “Attitude Propagation of Resident Space Objects with Recurrent Neural Networks”. In: Advanced Maui Optical and Space Surveillance Technologies Conference. Maui, Hawaii, USA, 2018.

[22] **D. Amato**, A. J. Rosengren, and G. Baù. “What Happened to Luna-3? A Numerical Exploration of Cislunar Dynamics”. In: John L. Junkins Dynamical Systems Symposium. College Station, Texas, USA, 2018.

[23] **D. Amato**, A. J. Rosengren, and C. Bombardelli. “THALASSA: A Fast Orbit Propagator for near-Earth and Cislunar Space”. In: 2018 Space Flight Mechanics Meeting. Kissimmee, Florida: American Institute of Aeronautics and Astronautics, 2018. DOI: 10.2514/6.2018-1970.

[24] J. Hernando-Ayuso, **D. Amato**, and C. Bombardelli. “Last-Minute Semi-Analytical Asteroid Deflection by Nuclear Explosion”. In: 5th IAA Planetary Defense Conference. Tokyo, Japan, 2017.

[25] A. J. Rosengren, **D. Amato**, J. Daquin, and I. Gkolias. “The Dynamical Placement of Satellite Constellations and Designing for Demise”. In: 9th International Workshop on Satellite Constellations and Formation Flying. Boulder, Colorado, USA, 2017.

[26] **D. Amato**, C. Bombardelli, and G. Baù. “Accurate Propagation of Planetary Encounters with Regularized Special Perturbations”. In: Final Stardust Conference. Noordwijk, The Netherlands, 2016.

[27] **D. Amato**, C. Bombardelli, and G. Baù. “Efficient Numerical Propagation of Planetary Close Encounters with Regularized Element Methods”. In: 6th International Conference on Astrodynamics Tools and Techniques (ICATT). Darmstadt, Germany, 2016.

[28] G. Baù, **D. Amato**, C. Bombardelli, and A. Milani. “New Orbital Elements for Accurate Propagation in the Solar System”. In: 6th International Conference on Astrodynamics Tools and Techniques (ICATT). Darmstadt, Germany, 2016.

[29] **D. Amato**, C. Bombardelli, and G. Baù. “Mitigation of Propagation Error in Interplanetary Trajectories”. In: *Spaceflight Mechanics 2015, Pts I-Iii*. 25th AAS/AIAA Spaceflight Mechanics Meeting. Ed. by R. Furfaro, S. Cassotto, A. Trask, and S. Zimmer. Vol. 155. I-III. Williamsburg, VA, USA: Univelt Inc, 2015, p. 1003.

[30] C. Bombardelli, **D. Amato**, J. L. Cano, and F. Cacciatore. “Mission Analysis for the Ion Beam Deflection of Fictitious Asteroid 2015PDC”. In: 4th IAA Planetary Defense Conference. Frascati, Italy, 2015.

Invited talks (6)

[31] **D. Amato**. “Ensuring Safe Space Operations through Novel Approaches in Computational Astrodynamics”. Invited talk (Cranfield University, Cranfield, UK). 2022.

[32] **D. Amato**. “Mars EDL Guidance under Dynamic Uncertainty”. Invited talk. Welcome Seminar (Imperial College London, London, UK). 2021.

[33] **D. Amato** and J. W. McMahon. “Martian Atmosphere Reconstruction through a Long Short-Term Memory Network”. Invited talk. DataLearning Working Group Meeting (Data Science Institute, Imperial College London, London, UK). 2021.

[34] **D. Amato**. “Advanced Orbit Prediction Methods and Applications in Near-Earth Space”. Invited talk. Aerospace and Mechanical Engineering Graduate Seminars (The University of Arizona, Tucson, AZ, USA). 2019.

[35] **D. Amato**. “New Concepts in Orbital Dynamics Applied to Space Situational Awareness”. Invited talk (Embry-Riddle Aeronautical University, Prescott, AZ, USA). 2019.

[36] **D. Amato**, D. Skoulidou, K. Tsiganis, and C. Bombardelli. “Comparison of Orbit Propagation Methods in High Eccentricities”. Invited talk. CNES Conference on HEO Orbits (CNES, Toulouse, France). 2017.

Software (2)

[37] **D. Amato**. *NAPLES: Numerical Analysis of PLanetary EncounterS*. 2019.

[38] **D. Amato**. *THALASSA: Orbit Propagator for near-Earth and Cislunar Space*. 2019.