Eleonora M. Botta

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Education

2013 - 2017 McGill University — Montreal, Canada
Ph.D. in Mechanical Engineering (GPA: 4.0).
Thesis: Deployment and capture dynamics of tether-nets for active space debris removal.
Supervisors: Prof. Arun K. Misra, Prof. Inna Sharf.

2010 - 2013 Politecnico di Milano — Milano, Italy
Laurea Specialistica (M.Eng. with thesis) in Space Engineering (Final grade: 110/110).

2010 - 2013 Politecnico di Torino — Torino, Italy
Laurea Specialistica (M.Eng. with thesis) in Aerospace Engineering.

2010 - 2013 Alta Scuola Politecnica — Milano-Torino, Italy
Diploma. Excellence program in innovation and multidisciplinarity.

2011 - 2012 Institut Supérieur de l'Aéronautique et de l'Espace (ISAE SUPAERO) — Toulouse, France
ERASMUS international program. Space Systems / Control Systems.

2007 - 2010 Politecnico di Milano — Milano, Italy
Laurea (**B.Eng.) in Aerospace Engineering (Final grade: 109/110).**

Professional Experience

2019 – Present **Assistant Professor**. Department of Mechanical and Aerospace Engineering, University at Buffalo.

2018 **Postdoctoral Fellow**. Department of Mechanical Egineering, McGill University / GlobVision.
Advancing capabilities of software for Space Situational Awareness.

2013 – 2017 **Research Assistant**. Department of Mechanical Egineering, McGill University.
Deployment and capture dynamics of tether-nets for active space debris removal.

2014 **Research Assistant**. Department of Mechanical Egineering, McGill University.
Development of the dynamical model of a three-revolute spherical wrist.

Citation Summary

Google Scholar (as of August 16, 2021) link — Citations: 199 | h-index: 6 | i10-index: 5

Web of Science (as of August 16, 2021) link — Citations: 115 | h-index: 6

ORCID: orcid.org/0000-0001-8983-2927 — **ResearcherID:** AAF-1884-2020

Publications

Refereed journal articles

(Corresponding author underlined; * denotes E.M. Botta's graduate student; + denotes E. M. Botta's undergraduate student)

J7. C. Barnes+, **E.M. Botta**. *A Quality Index for Net-Based Capture of Space Debris*. Acta Astronautica. Vol. 176 (2020), pp. 455-463. DOI:10.1016/j.actaastro.2020.06.044

J6. **E.M. Botta**, C. Miles, and I. Sharf. *Simulation and Tension Control of a Tether-Actuated Closing Mechanism for Net-Based Capture of Space Debris*. Acta Astronautica. Vol. 174 (2020), pp. 347-358. DOI:10.1016/j.actaastro.2020.04.052

J5. **E.M. Botta**, I. Sharf, and A.K. Misra. *Simulation of Tether-Nets for Capture of Space Debris and Small Asteroids*. Acta Astronautica. Vol. 155 (2019), pp. 448-461. DOI:10.1016/j.actaastro.2018.07.046

J4. **E.M. Botta**, I. Sharf, and A.K. Misra. *Energy and Momentum Analysis of the Deployment Dynamics of Nets in Space*. Acta Astronautica. Vol. 140 (2017), pp. 554-564. DOI:10.1016/j.actaastro.2017.09.003

J3. I. Sharf, B. Thomsen, **E.M. Botta**, A.K. Misra. *Experiments and Simulation of a Net Closing Mechanism for Tether-Net Capture of Space Debris*. Acta Astronautica. Vol. 139 (2017), pp. 332-343. DOI:10.1016/j.actaastro.2017.07.026

J2. **E.M. Botta**, I. Sharf, and A.K. Misra. *Contact Dynamics Modeling and Simulation of Tether Nets for Space-Debris Capture*. Journal of Guidance, Control, and Dynamics. Vol. 40, No. 1 (2017), pp. 110-123. DOI:10.2514/1.G000677

J1. **E.M. Botta**, I. Sharf, M. Teichmann, and A.K. Misra. *On the Simulation of Tether-Nets for Space Debris Capture with Vortex Dynamics*. Acta Astronautica. Vol. 123 (2016), pp. 91-102. DOI:10.1016/j.actaastro.2016.02.012

Books

P. Freni, **E.M. Botta**, L. Randazzo, and P. Ariano. *Innovative Hand Exoskeleton Design for Extravehicular Activities in Space*. SpringerBriefs in Applied Sciences and Technology, 2014. ISBN 978-3-319-03958-9.

Conference papers

(Presenter name underlined; *denotes E.M. Botta's graduate student; + denotes E. M. Botta's undergraduate student)

C13. G. Hecht*, **E. M. Botta**. *Co-State Initialization with Particle Swarm Optimization for Low-Thrust Minimum-Fuel Trajectory Optimization*. 2021 AAS/AIAA Astrodynamics Specialist Conference, Virtual Meeting, August 2021.

C12. R. K. Shah*, C. Zeng, **E. M. Botta**, S. Chowdhury. *Reliability-Based Launch and Closure Optimization for a Net-Based Space Debris Capture System*. 2021 AIAA AVIATION Forum, Virtual Meeting, August 2021.

C11. D. Bourabah*, **E.M. Botta**. *Libration Reduction during Partial Satellite Retrieval of Vertical Three-Mass Tethered Systems*. 31st AAS/AIAA Space Flight Mechanics Meeting, Virtual Meeting, February 2021.

C10. C. Barnes+, **E.M. Botta**. *An Improved Quality Index for Net-Based Capture of Space Debris*. 2nd IAA Conference on Space Situational Awareness (ICSSA). Arlington, VA. January 2020.
(1st Place, Best Student Paper Award)

C9. N. Ravichandra+, **E.M. Botta**. *Output Space Mapping for Net-Based Debris Capture*. 2020 AIAA SciTech Forum and Exposition. Orlando, FL, January 2020.

C8. C. Miles, **E.M. Botta**, and I. Sharf. *Simulation and Tension Control of a Tether-Actuated Closing Mechanism for Net-Based Capture of Space Debris*. 70th International Astronautical Congress (IAC 2019). Washington D.C.,October 2019.

C7. R. Gold+, **E.M. Botta**. *Validation of a Simulation Tool for Net-Based Capture of Debris with Parabolic Flight Experiment Data*. 2019 AAS/AIAA Astrodynamics Specialist Conference. Portland, ME. August 2019.

C6. **E.M. Botta**, I. Sharf, and A.K. Misra. *Simulation of Tether-Nets for Capture of Space Debris and Small Asteroids.* 1st IAA Conference on Space Situational Awareness (ICSSA). Orlando, FL. November 2017.

C5. **E.M. Botta**, I. Sharf, and A.K. Misra. *Tether-Nets for Active Space Debris Removal: Effect of the Tether on Deployment and Capture Dynamics.* 27th AAS/AIAA Space Flight Mechanics Meeting. San Antonio, TX. February 2017. AAS 17-387.

C4. **E.M. Botta**, I. Sharf, and A.K. Misra. *Energy and Momentum Considerations in the Deployment Dynamics of Nets for Active Space Debris Removal.* 67th International Astronautical Congress. Guadalajara, Mexico. September 2016. IAC-16-A6.5.6

C3. **E.M. Botta**, I. Sharf, and A.K. Misra. *Evaluation of Net Capture of Space Debris in Multiple Mission Scenarios.* 26th AAS/AIAA Space Flight Mechanics Meeting. Napa, CA. February 2016. AAS 16-254.

C2. **E.M. Botta**, I. Sharf, M. Teichmann, and A.K. Misra. *On the Simulation of Tether-Nets for Space Debris Capture with Vortex Dynamics.* 66th International Astronautical Congress. Jerusalem, Israel. October 2015. IAC-15-A6.5.6

C1. **E.M. Botta**, I. Sharf, and A.K. Misra. *On the Modeling and Simulation of Tether-Nets for Space Debris Capture.* 25th AAS/AIAA Space Flight Mechanics Meeting. Williamsburg, VA. January 2015. AAS 15-260.

Theses

E.M. Botta. *Deployment and Capture Dynamics of Tether-Nets for Active Space Debris Removal.* Ph.D. Thesis, McGill University, 2017. Department of Mechanical Engineering.

E.M. Botta. *A Multidisciplinary Tool for the Combined Optimization of Manned Atmospheric Entry Vehicles and Their Trajectory.* Master's Thesis, Politecnico di Milano, 2013. Department of Aerospace Science and Technology.

Technical Presentations

Invited Talks

T5. *Dynamics and Control of Capturing Space Debris with Tether-Nets*, Department of Mechanical and Aerospace Engineering Seminar Series, University of Strathclyde, May 26, 2021.

T4. *Dynamics and Control of Capturing Space Debris with Tether-Nets*, Department of Mechanical and Aerospace Engineering Seminar Series, Syracuse University, April 16, 2021.

T3. *Dynamics and Control of Tether-Nets for Active Space Debris Removal*, UB Alumni Academy #6: The Space Race, March 22, 2021.

T2. *Dynamics and Control of Tether-Nets for Active Space Debris Removal*, Department of Aerospace Engineering and Mechanics Seminar Series, University of Minnesota, October 9, 2020.

T1. *Deployment and Capture Dynamics of Tether-Nets for Active Space Debris Removal*, The Daniel Guggenheim School of Aerospace Engineering Seminar Series, GeorgiaTech, October 30, 2017.

Conference abstracts (that do not appear in the conference papers section, presenter name underlined; *denotes E.M. Botta's graduate student.)

A3. R. K. Shah*, C. Zeng, S. Chowdhury, E. M. Botta. *Learning-Augmented Optimal Deployment of Net for Reliable Capture of Space Debris.* International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS 2020). Remote. October 2020.

A2. E.M. Botta, I. Sharf, and A.K. Misra. *Modeling and simulation of the deployment and capture phases of a net-based Active Debris Removal mission.* 4th International Workshop on Space Debris Modelling and Remediation. Paris, France. June 2016.

A1. E.M. Botta, I. Sharf, and A.K. Misra. *A simulation tool for the deployment and capture dynamics of nets for space debris removal.* CASI ASTRO 2016. Ottawa, ON. May 2016.

Grants

Total Amount Awarded: $678,573

Modeling, Design and Operation of Robotic Tether-Net Systems for Reliable Capture of Targets
PI: Eleonora M. Botta, Co-PI: Souma Chowdhury, NSF, 09/01/21 – 09/01/24, $503,573 (50% share).

CRII: FRR: Robotic cable-based de-tumbling of demised spacecraft
PI: Eleonora M. Botta, NSF, 09/01/21 – 09/01/23, $175,000 (100% share).

Digital Media & Online Features

1. Botta presents at the UB Alumni Academy: Spring Semester 2021 (March 2021).
2. Botta's student wins first place at the 2020 WE Local Des Moines Collegiate Competition (Aug. 2020)
3. Botta's undergraduate student recognized for outstanding scholarship (Aug. 2020)
4. Botta's undergraduate student wins best paper award at international conference (Feb. 2020)
5. GAMES 2016 Oral Session 1st Place Prize Recipient, Eleonora Botta (June 2016)
6. Meet the 2015 Amelia Earhart Fellows (June 2015)

Honors and Awards

2018	**Outstanding Teaching Assistant Award.** *Faculty of Engineering, McGill University, Canada.*
2017	**Second place, oral presentation competition.** *Department of Mech. Eng., McGill University, Canada.* 2nd McGill Mechanical Engineering Graduate Research Day.
2016	**First place, oral presentation competition.** *Department of Mech. Eng., McGill University, Canada.* 1st McGill Mechanical Engineering Graduate Research Day.
2015	**Amelia Earhart Fellowship.** *Zonta International.*
2013 - 2016	**McGill Engineering Doctoral Award (MEDA).** *Faculty of Engineering, McGill University, Canada.*
2013 – 2016	**Werner Graupe International Fellowship in Engineering.** *Antje Graupe Pryor Foundation, Canada.*
2010, 2013	**Giovanni Zampese Award.** *Banca di Credito Cooperativo Cantù, Italy.*
2013	**Scholarship for thesis carried out abroad.** *Politecnico di Milano, Italy.*
2011 - 2012	**ERASMUS scholarship.** *European Union / Italy Ministry of Education.*
2007 - 2012	**Tuition fees waiver.** *Politecnico di Milano / Alta Scuola Politecnica, Italy.*

Teaching Experience

Courses taught: *Department of Mechanical and Aerospace Engineering, University at Buffalo.*

- Orbital Mechanics (MAE 502 LEC): Newly developed course.

Fall 2020	Instructor Evaluation:	4.4/5	(Dept. Average: 4.2/5)
	Overall Course:	4.4/5	(Dept. Average: 3.9/5)
	Response Rate:	8/8	
Fall 2019	Instructor Evaluation:	4.2/5	(Dept. Average: 4.2/5)
	Overall Course:	4.1/5	(Dept. Average: 3.7/5)
	Response Rate:	9/10	

- Dynamics (EAS 208).

Spring 2020	Overall Course:	3.9/5

Teaching assistant. *Department of Mechanical Engineering, McGill University.*

- Mechanics 3 (MECH 315): Vibrations. Fall 2014, Fall 2015, Winter 2017.
- Mechanics 2 (MECH 220): Kinematics and Dynamics of Particles and Rigid Bodies. Summer 2015, Winter 2016, Fall 2016.
- System Dynamics and Control (MECH 412). Winter 2015, Fall 2015.

Grader. *Department of Mechanical Engineering, McGill University.*

- Spacecraft Dynamics (MECH 542). Fall 2016.
- Introduction to Robotics (MECH 572). Fall 2014.
- System Dynamics and Control (MECH 412). Winter 2014.

Research advising

Ph.D. research at UB.

- Grant Hecht, Ph.D., August 2020-present, degree expected May 2025. NASA Pathways Intern, starting Summer 2021.

Master's research at UB.

- Derek Bourabah, M.S., August 2019-August 2021, Graduated.
  Thesis: Effectiveness of Utilizing only Tether Length Rate During the Retrieval of Tethered Satellites.
- Raj Kalpeshkumar Shah, M.S., August 2020-August 2021, Graduated.
  Thesis: Computational Pipeline to Find Optimal Launch and Closure Strategy for Autonomous Tether-Net Space Debris Capture System.
- Liam Field, M.S., August 2020-present, degree expected May 2022.

Dissertations/Theses committee member

- Jeremy Chapman, Ph.D. degree expected 2021.

- Christopher Gnam, Ph.D. degree expected 2022.
- Stephen Gagnon, Ph.D. degree expected 2022.
- Steve Szklany, Ph.D. degree expected 2021.
- Hadarou Sare, M.S. degree 2021.
- Chuan Hsin (Cindy) Chang, M.S., May 2020.

Undergraduate research at UB.

- Iain Tierney, Spring 2021-present. (Computer Science)
- Nicolina Ricciardi, Spring 2021-present.
- Stephen Chen, Summer 2020-present.
- Derek Yu, Summer 2020-present.
- Achira Boonrath, Summer 2020-present. — Zimmer Award Recipient, Spring 2021.
- Cailean Woods, Spring 2020-present.
- Andrea Judasz, Summer 2020-Spring 2021.
- Charles Barnes, Fall 2019-Spring 2020. — ELN Conference Funding Recipient, Fall 2019.; ICSSA Best Student Paper 1st Place Award.; Dean's Undergraduate Achievement Award.
- Liam Field, Spring 2019-Summer 2020.
- Rachael Gold, Spring 2019-Summer 2020. — Zimmer Award Recipient, Fall 2019.; 1st place, Undergraduate collegiate competition, WE Local Des Moines, 2020.
- Niranjan Ravichandra, Spring 2019.
- Derek Bourabah, Spring 2019.

Undergraduate research at McGill University.

Corey Miles. Simulation and Control of a Tether-Actuated Closing Mechanism for Net-Based Capture of Space Debris. Co-supervisor with Prof. Inna Sharf. 2018-2019.

Professional Development

August 2020	**Design and Build an Online Course.** UB Center for Educational Innovation (CEI).
October 2019	**Designing Experiences Academy.** UB Center for Educational Innovation (CEI).
September 2019	**Making an Effective Syllabus.** UB Center for Educational Innovation (CEI).
August 2019	**Write Winning Grant Proposals.** UB Office of Research Advancement.
Spring 2019	**New Faculty Academy: writing/publishing.** UB University Libraries.
February 2019	**Supervising the UB way.** UB Organizational Development and Training.
January 2019	**Research Fundamentals Workshop.** UB Office of Research Advancement.
2017	**Teaching Techniques for Instructors Workshop.** McGill T-PULSE.
2017	**Graduate Teaching Development Workshop.** McGill T-PULSE.

2014 **AGSEM Teaching Assistant Training.** SKILLSETS – McGill University.

Service

- **Society Membership**
  - American Institute of Aeronautics and Astronautics, AIAA (2019 – Present).
    Member of Space Tethers Technical Committee.
  - American Astronautical Society, AAS (2016 – Present)
- **School & Departmental Service, UB**
  - DC Faculty hiring committee (2019-2020).
  - Judge for UB MAE Graduate Poster Competition (2019, 2020).
  - Participation into ABET evaluation of Mechanical Engineering program (2020).
- **Reviewer for Proposals**
  - National Science Foundation Reviewer 2021
  - National Aeronautics and Space Administration Reviewer 2020
- **Editor for Scientific Journals**
  - Guest Editor: Acta Astronautica, Special Issue (2020)
  - International Journal of Space Science and Engineering (2019 – Present)
- **Reviewer**
  - Journal of Guidance, Control, and Dynamics, AIAA. Nominated as Excellent Reviewer of JGCD in 2018, 2020.
  - Acta Astronautica, Elsevier
  - Nonlinear Dynamics, Springer
  - IEEE Transactions on Aerospace and Electronic Systems
  - IEEE Access
  - Communications in Nonlinear Science and Numerical Simulation, Elsevier
  - Advances in Space Research, Elsevier
  - Transactions of JSASS, Aerospace Technology Japan
  - International Journal of Astronautics and Aeronautical Engineering.
  - 2017 IEEE/RSI International Conference On Intelligent Robots And Systems (IROS 2017)
  - 57th IEEE Conference on Decision and Control (CDC 2018)
  - International Conference on Mechanical, Electric and Industrial Engineering (MEIE 2018)
  - 2020 IEEE Conference on Control Technology and Applications (CCTA)
  - ASCEND 2020 (topics: Transformative Research and Technology, Space Traffic Management and Integration, Defining the Space Economy, Space Exploration Architectures and Enabling Infrastructures)
- **Conference organization**
  - **Session Chair**
    - Track "Tethered Spacecraft Structure", AIAA ASCEND 2020. November 19, 2020.
    - Tracks "Tracking" and "Risk Assessment", 2nd IAA Conference on Space Situational Awareness (ICSSA). January 15, 2020.
- **Awards Committees**
  - Judge AIAA Abe M. Zarem Award for Distinguished Achievement (2019, 2020).

- **Mentorship**
  - Mentor, International Astronautical Federation (IAF) Abstract Mentor Programme, IAC 2020.
  - SEAS Faculty-Freshman Mentor (Spring 2019, 2020, 2021).
- **Community Outreach and Engagement**
  - Science is Elementary Mentor (2019 – Present).
- **Participation to accreditation process of the Mechanical Engineering program at McGill University.**
- **Volunteer at conferences.**
  - 17th Astronautics Conference of the Canadian Aeronautics and Space Institute (CASI ASTRO 2016).
  - 12th International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS 2014).

Communication

Languages

English, French Fluent. **Italian** Mothertongue.