

Andrea Togni

PHD CANDIDATE AND RESEARCH FELLOW · MECHANICS AND ADVANCED ENGINEERING SCIENCES

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Research Interests

My research interests are in the field of radio science applied to deep space missions, including implementation of ground segment solutions, development of radiometric and optical processing algorithms, and generation of orbit determination and navigation routines. Past experience includes support to the data analysis and simulation of multiple NASA/ESA missions (Juno, Bepicolombo, Cassini, Voyager, Hera) and various activities on DSN stations (DSS-17, DSS-69).

Employment History and Current Positions

Research Fellow

Forlì, Italy

RADIO SCIENCE AND PLANETARY EXPLORATION LAB, UNIVERSITY OF BOLOGNA

01/02/2023 - present

- Main activities: Processing of radiometric and optical observables for navigation around planets.
Integration of optical-based navigation algorithms into radiometric tracking procedures for the ESA mission BepiColombo.

Visiting Researcher

Morehead (KY), United States

SPACE SCIENCE CENTER, MOREHEAD STATE UNIVERSITY

01/08/2022 - 30/01/2023

- Main activities: Validation of DSN station DSS-17 tracking activities using radiometric data from lunar missions.
Support to spacecraft operations of the Lunar IceCube satellite as part of the Artemis 1 mission.
Development of SDR-based solutions to increase radiometric tracking capabilities of the station.

Intern

Forlì, Italy

MICROSATELLITES AND SPACE MICROSYSTEMS LABORATORY, UNIVERSITY OF BOLOGNA

01/06/2018 - 21/03/2019

- Main activities: Design and testing of testbeds and subsystems for microsatellite testing.

Tutor of the Degree Programmes in Mechanical Engineering

Forlì, Italy

FORLÌ CAMPUS, UNIVERSITY OF BOLOGNA

01/11/2016 - 31/12/2018

- Main activities: Supported the Degree Programme Coordinator in the management of students' practices.
Helped students, maintaining contacts with those who may encounter major difficulties at tests/exams and setting up a clear programming for their studies and career.
Active participation in orientation activities and surveying activities on the quality of the teaching activities.

Education

University of Bologna

Bologna, Italy

MECHANICS AND ADVANCED ENGINEERING SCIENCES, PHD

01/11/2019 - 31/01/2023

- Research Project: Deep and near Space Tracking Stations in Support of Lunar and Planetary Exploration Missions
- Main Activities: Development of processing algorithms for radiometric data in various formats.
Collaboration and characterization of tracking performance of multiple stations from the Deep Space Network.
Simulation and development of orbit determination procedures using data from multiple deep space exploration spacecrafts (Voyager, Cassini, Juno, Hera).

University of Bologna

Bologna, Italy

MECHANICAL ENGINEERING, MSC (110/110, CUM LAUDE)

01/09/2016 - 21/03/2019

- Final Project in: Spacecraft Attitude Dynamics and Control
- Academic Curriculum: Applied Mechanics, Control Theory, Thermodynamics and Machinery, Electric Power Systems.

Publications

PUBLISHED

- Gramigna, E., Johansen, J. G., Manghi, R. L., Magalhães, J., Zannoni, M., Tortora, P., ... & **Togni, A.** (2022, June). Hera Inter-Satellite link Doppler characterization for Didymos Gravity Science experiments. In 2022 IEEE 9th International Workshop on Metrology for AeroSpace (MetroAeroSpace) (pp. 430-435). IEEE.
- Togni, A.**, Zannoni, M., Casajús, L. G., & Tortora, P. (2021, June). An FFT-based method for Doppler observables estimation in Deep Space tracking. In 2021 IEEE 8th International Workshop on Metrology for AeroSpace (MetroAeroSpace) (pp. 294-299). IEEE.
- Modenini, D., Bahu, A., Curzi, G., & **Togni, A.** (2020). A dynamic testbed for nanosatellites attitude verification. *Aerospace*, 7(3), 31.

IN PREP

- Togni, A.**, Zannoni, M., Tortora, P., Robust and accurate frequency estimation from a single FFT point.

Teaching Experience

- Spring 2023. **Teaching assistant** for 11361 - Computer Aided Design.
B.Sc. Mechanical Engineering,
University of Bologna.
- Spring 2022. **Teaching assistant** for 11361 - Computer Aided Design.
B.Sc. Mechanical Engineering,
University of Bologna.
- Spring 2021. **Teaching assistant** for 11361 - Computer Aided Design.
B.Sc. Mechanical Engineering,
University of Bologna.
- Spring 2020. **Teaching assistant** for 11361 - Computer Aided Design.
B.Sc. Mechanical Engineering,
University of Bologna.

Presentations

INVITED TALKS

- January 2023. *Deep Space Navigation From Around the World*. Invited talk: Space Science Center Technical Talk, Morehead (KY), United States.
- November 2020. *Signal Analysis in Orbit Determination*. Invited talk: Euroavia Space Rendez-Vous, Forlì, Italy.

GUEST LECTURES

- Fall 2022. *Astrodynamics, Orbit Determination, and Applications*.
M.Sc. Space Systems Engineering,
Morehead State University.
- Fall 2021. *Design Methods in the Aerospace Industry*, Series of Lectures.
M.Sc. Aerospace Engineering,
University of Bologna.
- Spring 2021. *MATLAB: A Practical Approach to Time-Frequency Signal Analysis*.
Ph.D. Automotive Engineering for Intelligent Mobility, Ph.D. Mechanics and Advanced Engineering Sciences,
University of Bologna.
- Spring 2021. *Fundamentals of Numerical Computing*.

M.Sc. Advanced Automotive Engineering,
University of Bologna.

Spring 2021. *Fundamentals of Numerical Computing*.
M.Sc. Mechanical Engineering,
University of Bologna.

Spring 2021. *MATLAB Fundamentals*.
M.Sc. Advanced Automotive Engineering,
University of Bologna.

Spring 2021. *MATLAB Fundamentals*.
M.Sc. Mechanical Engineering,
University of Bologna.

Fall 2020. *Design Methods in the Aerospace Industry*, Series of Lectures.
M.Sc. Aerospace Engineering,
University of Bologna.

Spring 2020. *Fundamentals of Numerical Computing*.
M.Sc. Advanced Automotive Engineering,
University of Bologna.

Spring 2020. *Fundamentals of Numerical Computing*.
M.Sc. Mechanical Engineering,
University of Bologna.

Spring 2020. *MATLAB Fundamentals*.
M.Sc. Advanced Automotive Engineering,
University of Bologna.

Spring 2020. *MATLAB Fundamentals*.
M.Sc. Mechanical Engineering,
University of Bologna.

Fall 2019. *Design Methods in the Aerospace Industry*, Series of Lectures.
M.Sc. Aerospace Engineering,
University of Bologna.

Supervision of Students

2020-2022 **Co-supervisor of 6 B.Sc. thesis**, B.Sc. in Aerospace Engineering

2020-2021 **Co-supervisor of 1 M.Sc. thesis**, M.Sc. in Aerospace Engineering

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