Ilaria Cannizzaro

SPACE ENGINEER

Personal Information

Date of Birth	27 July 1993
Mobile	
E-mail	
E-mail Institutional	
Address	

Education

Special Master	**Aerospace Engineering**, (2023-ongoing), *Sapienza Università di Roma*, Roma, Italy.
Master's Degree	**Space Engineering**, (2017-2022), *Politecnico di Milano*, Milano, Italy.
Bachelor's Degree	**Aerospace Engineering**, (2012-2017), *Politecnico di Milano*, Milano, Italy.
High School	**Scientific High School**, (2007-2012), *IIS Italo Calvino*, Rozzano, Italy.

Programming Skills and Software

Programming Languages	MATLAB®, Simulink, Python
Frameworks & Libraries	NumPy, Pandas, TensorFlow Keras
Software	Office, Autodesk Inventor, Dassault SolidWorks, Siemens PLM Solid Edge
OS	Linux, Microsoft Windows

Work Experience

Technical Consultant

Navigation Engineer, (December 2021 - January 2024), *Northrop Grumman Italia*, Pomezia, Italy.

This work experience allowed me to deeply understand the practical aspects and the theoretical assumptions behind the use of the error state extended Kalman Filter (EKF) for aircraft navigation. In detail, with this work, I improved my knowledge of:

- Inertial and aiding sensors modeling and design.
- Modelling and simulation of the inertial navigation system with GPS integration (INS/GPS).
- Kalman filtering for multi-sensor fusion applications.
- Aircraft mechanization equation implementation.
- Navigation software requirements analysis and design.

I worked on the implementation of the model of the navigation software in MATLAB® Simulink. Lately, I was also responsible for coordinating the activities in collaboration with a Mathworks consultant in the context of:

- Model-Based Design for System Engineering: automatic code generation from the MATLAB® Simulink model and performance evaluation of the auto-generated C code on the real navigation system.

External Projects

Coauthor

Q-Cube a 100 Euro Satellite, (March 2024 - ongoing).

Q-Cube is a project of the British Interplanetary Society intended to be suitable for construction by senior high school or undergraduate project teams. The goal is to provide practical engineering experience with a complete Cubesat system for pre-graduate students. For this purpose, the construction is designed to be achievable with simple facilities and a material budget of around 100 Euros. Once the design is validated, all project and manufacturing details will be made publicly available on an open-source framework, allowing anyone to use it as the basis for a future satellite project. A paper abstract for this project was submitted to the 75th International Astronautical Congress in 2024.

Academic Projects and Reports

Project

Robotics & **AI**, (February 2024).

The idea behind this project is to further exploit the Reachability Map dataset developed during my master's thesis to extract valuable information for a possible robotic application. One interesting function is to provide a suitable initial estimate for inverse kinematic computations in an onboard robotic scenario. For this purpose, an artificial neural network approach has been selected. In particular, the network takes the pose of the end-effector as input and produces a predicted solution for the inverse kinematics problem as output. Several ANN architectures were compared in terms of performance. The most promising architecture was tested by computing the final end-effector position error. Possible ways to further improve performance were proposed and discussed.

Master Thesis Project

Neural Network-Based Reachability Map For Autonomous On-Orbit Robotic Manipulation, (March 2020).

My master thesis was about the modelling and design of the reachable workspace of a 7DOFs spacecraft-mounted robotic arm. The robot's workspace model, called Reachability Map, was implemented from scratch in MATLAB® Simulink environment. The map contained precomputed solutions of the inverse kinematic for a user-defined number of discretized end-effector poses. Simulations were carried out and used for preliminary evaluation of the arm manipulation capabilities. Furthermore, the Reachability map dataset was used to train a feedforward neural network developed in Keras TensorFlow for a possible on-orbit servicing real scenario.

Project

Payload Design, (July 2019).

Moon Orbit Radiation in Yeast (MOONRAY) is the conceptual design of a spacecraft made by a 5-person group to study how organisms react to radiation beyond the Van Allen Belts, more specifically around the moon, for an extended period. Mission design produced a 12U CubeSat equipped with a dual payload: the biological payload and a Radiation Detection System. A system breakdown approach was applied to define all system components along with their requirements. The final documents submitted included a full report with detailed descriptions of each sub-system and requirements document in line with ECSS standards.

Project **Spacecraft Attitude Dynamics and Control**, (January 2019).
Analysis and design of the attitude behavior of a CubeSat injected into a LEO orbit.
The purpose of this project is to study the attitude behavior and control of a 6U CubeSat. The spacecraft is injected into a LEO orbit with an inevitable and undesirable initial angular velocity which has to be stabilized with adequate maneuvers that guarantee the completion of the assigned mission. The attitude model is implemented in MATLAB® Simulink and used to simulate the dynamic problem, taking into account the effects of the orbital environment. Furthermore, the model also includes sensors, actuators, and control laws to control the spacecraft's tumbling motion.

Project **Orbital Mechanics**, (October-December 2019).
Design of an interplanetary trajectory of a spacecraft in a voyage from a planet to another of the solar system through a flyby of a third planet.
This project covers the trajectory design for a transfer from Jupiter to Mercury, including a gravity assist performed around the Earth. An exploratory study was carried out to determine a lower cost threshold, that is to say, the minimum possible cost of the trajectory in terms of km/s. This was done by looking at the pork-chop plot, which shows the delta-V cost of interplanetary travel in function of departure and arrival dates. The trajectory has been designed to minimize the overall delta-V with the resolution of Lambert's problem for the heliocentric transfers and using a linked-conics approach to model the gravity assist maneuver.

Project **Launch Systems**, (October-December 2018).
FIrst REusable Foldable Launcher (FIREFly) is a conceptual design of medium-small launchers with a reusable first stage.

University Membership **Skyward Experimental Rocketry**, (2013-2015).
Association of students from Politecnico of Milano born to design, develop and launch prototypes of rockets of small and medium size. I was part of the propulsion and computational rocket dynamics (CRD) teams

Part-Time Work and Affiliations

Membership **The British Interplanetary Society (BIS)** (2023)

Worker **Waitress**, (2015-2017), *Restaurant Wiener Haus*, Rozzano, Italy.

Volunteer **Night ambulance service**, (2012-2013), *Croce Viola*, Rozzano, Italy.

Languages

Italian *Mothertongue*

English *C1 level*

Additional Info

Driving Licence *B*

Interests and Sports

- **Master Swimming Team** (Member)
- **Mountain climbing and hiking**