Lorenzo Becce

Curriculum vitae

Current

Aug. 2021 - current
Research Assistant in Agricultural Machinery and Mechanization, *Free University of Bozen-Bolzano*, Competence Centre for Plant Health.

supervisor
prof. F. Mazzetto

description
Investigation of the performance of sprayers for agricultural use with the aid of a wind tunnel, especially in terms of the control of primary and secondary drift phenomena in the distribution of plant phytosanitary products. Development of a data acquisition systems based on optical sensors and ultrafast-imaging systems for the study of flow propagation phenomena related to secondary drift and interception systems to quantify the amount of product deposited on appropriate target media.
Main activities:

- Reverse engineering, design and implementation of data post-processing routines to overcome limitations of commercial test benches and adapt them to custom needs such as aggregation, comparison and visualisation of data from laboratory equipment;
- Extensive experience with Particle/Droplet Image Analysis for the characterisation of multiphase flows, especially of liquid droplets in air at micrometre scale, research on liquid atomisation phenomena and modeling of macroscopic aerosol transport;
- Extensive experience in testing air distribution systems from air-assisted sprayers;
- Design of wind tunnel experiments for the measurement of spray deposition and the size characterisation of aerosol from commercial orchard sprayers;
- Analysis of reference international standards for testing agricultural equipment, consequent design and adaptation of test benches, selection and procurement of test equipment with private companies;
- Analysis of requirements, selection and procurement of laboratory instrumentation and facilities in support of research activities;
- Risk analysis and redaction of Standard Operative Procedures for laboratory instrumentation;
- Coordination of research+third mission agreements with local and international stakeholders;
- Participation in proposal, execution and reporting of international projects with fellow research centres.

Sept. 2021 - current
Teaching Assistant, *Agricultural Machinery and Mechanization*, (prof. F. Mazzetto), Free University of Bozen-Bolzano.

Correction of exercises, assistance to students, laboratory demonstrations, active participation in final examinations

Sept. 2023 - current
Teaching Assistant, *Information and Decision Support Systems in Fruit Production*, (prof. G. Carabin), Free University of Bozen-Bolzano.

Conduction of exercises on elaboration of raw GNSS data, GIS systems, practical laboratory demonstrations

Education

Nov. 2022 - current
PhD in Advanced Systems Engineering, *Free University of Bozen-Bolzano (unibz)*.

supervisors
prof. F. Mazzetto, prof. R. Vidoni

description
Investigation of the performance of sprayers for agricultural use in controlled environment, especially in terms of monitoring and control of drift phenomena. Leveraging existing facilities at unibz, including a sort of wind tunnel, the project focuses on three lines of action: (a) basic and advanced characterisation of spray nozzles in terms of droplet generation, (b) research into advanced techniques for the characterisation of spray deposition and aerosol drift, and (c) employment of optical systems for aerosol cloud quantification.

mar. 2018– dec. 2020
Master of Sciences in Aerospace Engineering, *Politecnico di Torino*, Torino, *103/110*.
Aeromechanics & Systems Engineering

Thesis title
Guidance and Control strategies for UAS applications for Precision Agriculture

supervisors
prof. G. Guglieri, dr. N. Bloise

description Development of a waypoint-based guidance algorithm for an autonomous UAS over a number of plants in order to precisely administer plant protection products. A feasible path through the yard is generated by a Traveling Salesman Problem (TSP) solver and a suitable path planning routine (Theta*) based on a Digital Elevation Model (DEM) of the field for obstacle avoidance. Then, the UAS autopilot is implemented in Simulink and fed the obtained path for the execution of the task.

2014–2018 **Bachelor of Sciences in Aerospace Engineering - EASA part 66**, *Politecnico di Torino*, Torino, *90/110*.

Thesis title *Development of a pressurization module for small aircraft*

supervisors prof. M. Battipede, prof. P. Maggiore

description Preliminary and conceptual approach to the design of an Environmental Control System for aircraft, focusing on the relations between components and control laws. With a high flexibility requirement, the scheme has been implemented and tested in Simulink.

Participation in Research Projects

Aug. - Dec. 2021 **BROTWEG - a Path of Bread in Alpine Environments**, *FESR*.

The project BROTWEG sought to recover the cereal value chain in extreme mountain areas through responsible mechanisation in partnership with local stakeholders. The project proposed new development models for mountain agriculture to complement the pasture-livestock model, currently prevailing in the region.
Contributions:

- participation in the sampling campaign for the evaulation of the performances of teh developed machines
- recovery of raw GNSS data for the monitoring of operational performances
- redaction of parts of the documenting literature and final reports

Jul. - Dec. 2022 **USAGE - Up-Skilling Agricultural Engineering in Europe**, *Erasmus+*.

Dec. 2022 - onw. **USAGE – Next Generation in Europe and Abroad**, *Erasmus+*.

The two projects strive to enable smart, sustainable and inclusive growth of the skills and competencies of workers in the agricultural sector through innovative pedagogic approaches and practical experience with state of the art technologies. Through a fruitful cooperation between universities and companies, the project developed curricula of a modularized lifelong learning programmes at the host universities: the Swedish University of Agricultural Sciences, the University of Natural Resources and Life Sciences, Vienna, the Technical University of Munich and the Free University of Bozen-Bolzano.
Main contributions:

- Participated in meetings for the periodic reporting of activities
- Held lectures and practical laboratory demonstrations for the continuing education courses developed within the project framework
- Participated in the drafting of documents for proposal of the second project

Languages

Italian	Native	
English	Proficient	*Certified B2 FCE and at unibz*
German	Proficient	*Certified B1 at unibz*
French	Intermediate	

Computer skills

CAD	SolidWorks, FreeCAD	Organization	Vim, MS Excel, LaTeX
Programming	C/C++, Arduino, Python	Num. Modelling	MATLAB, Simulink
Oper. Syst.	Windows, Ubuntu	GIS	QGIS/QField
Graphics	Inkscape, Gimp		

Memberships

2024 onw. **"Cultore della Materia" for Agricultural Mechanisation**.

2021 onw. **Italian Association of Agricultural Engineering (AIIA)**.

2020 onw. **Honorary Member of the Aerospace Engineering Students' Association (AESA)**, *Politecnico di Torino*. Member of the Directive Board in A.Y. 2016-2017. Coordinated small teams of students to organize conferences with experts in the field of aeronautics and space exploration, visits to companies in the industry and other minor events. I organized and personally held some divulgative meetings on the history of space exploration for students.

- gained good knowledge of the interaction with groups, experts and stakeholders;
- practiced teamwork and team organization;
- practiced leadership and negotiation;
- fostered my keenness for teaching and communication.

Participation in Conferences

Sept. 21-24, 2025 **AIIA 2025: Biosystems Engineering for the Green Transition**, *Reggio Calabria, IT*.
Poster presentation

Multirow vineyard sprayers: new airflow calibration approach by ultrasonic anemometry

Mar. 11-14, 2025 **50th Symposium "Actual Tasks on Agricultural Engineering"**, *Opatija, HR*.
Contributed paper

Orchard sprayer performance: a methodological approach toward environmental improvement

Sept. 17-19, 2024 **AIIA Mid-Term Conference: Biosystems Engineering Promoting Resilience To Climate Change**, *Padova, IT*.
Contributed paper

First experiences in data handling to characterise air distribution from airblast sprayers

Nov. 6-8, 2023 **2023 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)**, *Pisa, IT*.
Contributed paper

Nozzle characterisation to support aerosol spray drift measurement in a Semi-Controlled environment

Feb. 28 - Mar. 2, 2023 **49th Symposium "Actual Tasks on Agricultural Engineering"**, *Opatija, HR*.
Contributed paper

Evaluation of air flow influence on sprayer nozzle performance by shadowgraphy

Nov. 3-5, 2022 **2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)**, *Perugia, IT*.
Contributed paper

Preliminary spray nozzle characterization activities through shadowgraphy at the AgroForestry Innovation Lab (AFI-Lab)

Sept. 19-22, 2022 **AIIA 2022: Biosystems Engineering Towards the Green Deal**, *Palermo, IT*.
Poster presentation

Agroforestry Innovations Lab Activities on Sprayer Performance and Certification

June 15-17, 2021 **International Conference on UAS (ICUAS 21)**, *Athens, GR*.
Contributed paper

Optimal Path Planning for Autonomous Spraying UAS framework in Precision Agriculture

Publications

Ayesha Ali, Antonio Altana, Lorenzo Becce, Paolo Lugli, Luisa Petti, and Fabrizio Mazzetto. Enhancing Spray Drift Deposition Analysis: Towards Real-Time Estimation through Resistive Measurements and Optical Tracers. In *2023 IEEE International Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, pages 652–656, Pisa, Italy, November 2023. IEEE.

Ayesha Ali, Lorenzo Becce, Andreas Gronauer, and Fabrizio Mazzetto. Methodological Advancement in Resistive-Based, Real-Time Spray Deposition Assessment with Multiplexed Acquisition. *AgriEngineering*, in press.

Antonio Altana, Lorenzo Becce, Enrico Avancini, Paolo Lugli, Luisa Petti, and Fabrizio Mazzetto. Cost-effective tracing techniques for the rapid characterization of spray deposition and drift through electrical conductivity and fluorescence. In *2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, pages 164–168, Perugia, Italy, November 2022. IEEE.

Antonio Altana, Lorenzo Becce, Paolo Lugli, Luisa Petti, and Fabrizio Mazzetto. Uranine as a Tracer for Rapid Detection of Spray Deposition. In Vito Ferro, Giuseppe Giordano, Santo Orlando, Mariangela Vallone, Giovanni Cascone, and Simona M. C. Porto, editors, *AIIA 2022: Biosystems Engineering Towards the Green Deal*, volume 337, pages 241–249, Cham, 2023. Springer International Publishing.

Arrigo Avi, Lorenzo Becce, Giuseppe Quaranta, Fabrizio Mazzetto, and Riccardo Parin. Characterization of the Spray System of the TerraXcube Icing Wind Tunnel. *Aerotecnica Missili & Spazio*, June 2024.

Lorenzo Becce, Saba Amin, Giovanni Carabin, and Fabrizio Mazzetto. Preliminary spray nozzle characterization activities through shadowgraphy at the AgroForestry Innovation Lab (AFI-Lab). In *2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, pages 136–140, Perugia, Italy, November 2022. IEEE.

Lorenzo Becce, Nicoletta Bloise, and Giorgio Guglieri. Optimal Path Planning for Autonomous Spraying UAS framework in Precision Agriculture. In *2021 International Conference on Unmanned Aircraft Systems (ICUAS)*, pages 698–707, Athens, Greece, June 2021. IEEE.

Lorenzo Becce, Giovanni Carabin, and Fabrizio Mazzetto. Agroforestry Innovations Lab Activities on Sprayer Performance and Certification. In Vito Ferro, Giuseppe Giordano, Santo Orlando, Mariangela Vallone, Giovanni Cascone, and Simona M. C. Porto, editors, *AIIA 2022: Biosystems Engineering Towards the Green Deal*, volume 337, pages 305–313, Cham, 2023. Springer International Publishing.

Lorenzo Becce, Giovanni Carabin, and Fabrizio Mazzetto. Evaluation of air flow influence on sprayer nozzle performance by shadowgraphy. In *49th Symposium "Actual Tasks on Agricultural Engineering"*, pages 59–67, Opatija, 2023.

Lorenzo Becce, Merve Karaca, Ayesha Ali, Giovanni Carabin, and Fabrizio Mazzetto. First Experiences in Data Handling to Characterise Air Distribution from Airblast Sprayers. In Luigi Sartori, Paolo Tarolli, Lorenzo Guerrini, Giulia Zuecco, and Andrea Pezzuolo, editors, *Biosystems Engineering Promoting Resilience to Climate Change - AIIA 2024 - Mid-Term Conference*, volume 586, pages 697–704. Springer Nature Switzerland, Cham, 2025.

Lorenzo Becce, Giovanna Mazzi, Ayesha Ali, Mara Bortolini, Andrea Gambaro, and Fabrizio Mazzetto. Nozzle Characterisation to Support Aerosol Spray Drift Measurement in a Semi-Controlled Environment. In *2023 IEEE International Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, pages 646–651, Pisa, Italy, November 2023. IEEE.

Lorenzo Becce, Giovanna Mazzi, Ayesha Ali, Mara Bortolini, Elena Gregoris, Matteo Feltracco, Elena Barbaro, Daniele Contini, Fabrizio Mazzetto, and Andrea Gambaro. Wind Tunnel Evaluation of Plant Protection Products Drift Using an Integrated Chemical–Physical Approach. *Atmosphere*, 15(6):656, May 2024.

G. Carabin, L. Becce, and F. Mazzetto. Development and Experimental Evaluation of a Tractor Roll-Over Stability Model. In *Lecture Notes in Civil Engineering*, volume 337 LNCE, pages 429–436, 2023.

Giovanni Carabin, Lorenzo Becce, Andreas Mandler, and Fabrizio Mazzetto. Primary Production Prediction from Aerial Spectrographic Survey. In *2022 IEEE Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, pages 350–355, Perugia, Italy, November 2022. IEEE.

Giovanni Carabin, Merve Karaca, Francesco Fabio Nicolosi, Lorenzo Becce, and Fabrizio Mazzetto. Rollover Stability Performance Tests of Tractors Commonly Used in Mountain Agroforestry Operations. In Luigi Sartori, Paolo Tarolli, Lorenzo Guerrini, Giulia Zuecco, and Andrea Pezzuolo, editors, *Biosystems Engineering Promoting Resilience to Climate Change - AIIA 2024 - Mid-Term Conference*, volume 586, pages 405–413. Springer Nature Switzerland, Cham, 2025.

Lavinia Eleonora Galli, Lorenzo Becce, Francesco Fabio Nicolosi, Fabrizio Mazzetto, and Domenico Pessina. Efficiency and Environmental Impact of Tractors Used in Specialized Crops of Autonomous Province of Bolzano. In Luigi Sartori, Paolo Tarolli, Lorenzo Guerrini, Giulia Zuecco, and Andrea Pezzuolo, editors, *Biosystems Engineering Promoting Resilience to Climate Change - AIIA 2024 - Mid-Term Conference*, volume 586, pages 841–849. Springer Nature Switzerland, Cham, 2025.

N.A. Khan, G. Carabin, F.F. Nicolosi, L. Becce, S. Amin, A. Ali, M. Karaca, G. Orzes, and F. Mazzetto. Performance Evaluation of Two Commercial Proximal Sensors in Detecting Copper and Drought Stresses on Grapevine Under Controlled Environment. In *Lecture Notes in Civil Engineering*, volume 586 LNCE, pages 739–745, 2025.

A. Mandler, G. Carabin, L. Becce, S. Liberatori, H. Bernhardt, M. Treiber, C. Paulus, A. Gronauer, A. Herlin, and F. Mazzetto. LLL Strategies for New Educational Approaches in Smart Agriculture from an Agricultural Engineering Perspective in Italy. In *Lecture Notes in Civil Engineering*, volume 337 LNCE, pages 697–704, 2023.

A. Mandler, F.F. Nicolosi, L. Becce, F. Mazzetto, and G. Carabin. INNOVATIVE ENGINEERING EDUCATION IN THE WAKE OF SMART AGRICULTURE. REVISION OF THE AGRICULTURAL ENGINEERING CURRICULUM. In *SEFI 2023 - 51st Annual Conference of the European Society for Engineering Education: Engineering Education for Sustainability, Proceedings*, pages 2426–2434, 2023.

Andreas Mandler, Lorenzo Becce, Giovanni Carabin, Andreas Gronauer, and Fabrizio Mazzetto. Mechanisation of Mountain Farming. Observations on Grain Production in the Alps. In Luigi Sartori, Paolo Tarolli, Lorenzo Guerrini, Giulia Zuecco, and Andrea Pezzuolo, editors, *Biosystems Engineering Promoting Resilience to Climate*

Change - AIIA 2024 - Mid-Term Conference, volume 586, pages 807–815. Springer Nature Switzerland, Cham, 2025.

F. Mazzetto, G. Carabin, L. Becce, A. Mandler, and P. Sacco. Technological Solutions for Implementing Sustainable Cereal-Based Value-Chains in High Mountain Areas. In *Lecture Notes in Civil Engineering*, volume 337 LNCE, pages 733–741, 2023.

Giovanna Mazzi, Lorenzo Becce, Ayesha Ali, Mara Bortolini, Elena Gregoris, Matteo Feltracco, Elena Barbaro, Andreas Gronauer, Andrea Gambaro, and Fabrizio Mazzetto. Methodological Advancements in Testing Agricultural Nozzles and Handling of Drop Size Distribution Data. *AgriEngineering*, 7(5):139, May 2025.

P. Sacco, D. Don, L. Becce, G. Carabin, A. Mandler, and F. Mazzetto. Sustainability Performance of Mountain Food Value Chains. In *Lecture Notes in Civil Engineering*, volume 337 LNCE, pages 901–908, 2023.

C.M. Sebald, S. Grebner, M. Mayr, V. Vidric, A. Mandler, L. Becce, C. Paulus, G. Carabin, F. Mazzetto, and H. Bernhardt. Up-skilling the next generation in Agricultural Engineering in Europe. 2025.