UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Activities and Publications Report

PhD Student: Aniello Mungiello

Student DR number: DR996969

PhD Cycle: XXXVIII
PhD Chairman: Prof. Stefano Russo

PhD program student's start date: 01/01/2023
PhD program student's end date: 31/12/2025

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Co-supervisor:

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PhD scholarship funding entity: PNRR MOST SPOKE : CCAM e Smart Infra

General information

Aniello Mungiello received in year 2022 the Master Science degree in Autonomous Vehicle Engineering from the University of Napoli Federico II. Within the PhD program in Information Technology and Electrical Engineering, he attended a curriculum in Automation/Robotics Engineering. He received a grant from PNRR MOST SPOKE : CCAM e Smart Infra.

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organizer(s)
1st	Statistical data analysis for science and engineering research	Ad hoc course	4	Prof. Roberto Pietrantuono	ITEE
1st	Electronic Scan Antennas for Radar Signal Processing Applications	Ad hoc course	2	Dr. Enzo Carpentieri	ITEE
1st	The Linear Parameter Varying approach: theory and application	Ad hoc course	4	Prof. Olivier SENAME	ITEE
1st	Academic Entrepreneurship	Ad hoc course	4	Prof. Pierluigi Rippa	ITEE
1st	Percorso per il rafforzamento delle competenze sulla progettazione europea (Modulo 1-3-4)	Ad hoc course	1.6	Dr. Tommaso FOGLIA, Dr. Federico PORCEDDA. Dr. Veronica ROCCO	ITEE
2nd	Matrix Analysis for Signal Processing with MATLAB Examples	Ad hoc course	3	Dr. Massimo Rosamilia	ITEE
2nd	Automotive Cyber Security Academy	Ad hoc course	3.2	Prof. CHRISTIAN CARMINE ESPOSITO	UNISA

Attended PhD Schools

Year	School title	Location	Credits	Dates	Organizer(s)
1st	Learning-based predictive control	Zurich, Switzerland	4	26-27-28-29-30/06/2023	European Embedded Control Institute
2nd	AS3 – Automotive Software Summer School	Nardò Technical Center	8	10-20/09/2024	Nardò Technical Center – Porsche Engineering

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organizer(s)
1st	Is control a solved problem for aerial robotics research?	0.2	Prof. Antonio Franchi	University of Sapienza Rome	ITEE
1st	Towards Occlusion-Aware Autonomy using People as Sensors	0.2	Prof. Katie Driggs-Campbell	University of Illinois at Urbana-Champaign	Autonomy Talk (ETH)
1st	Learning Robot Super Autonomy	0.2	Prof. Giuseppe Loianno	University of California, Berkeley	Autonomy Talk (ETH)
1st	Multi-robot Control of Heterogeneous Herds	0.2	Prof. Eduardo Montijano	University of Zaragoza	SSM
1st	Safe legged locomotion and navigation: robust motion planning and interactive decision-making	0.2	Prof. Ye Zhao	George Woodruff School of Mechanical Engineering	Autonomy Talk (ETH)
1st	Industry 4.0 Fundamentals in Bosch Applications	2	Eng. Martino Bruni	*Bosch*	Politecnico di Bari
1st	Using Delay for Control	0.2	Prof. Emilia Fridman	Tel Aviv University	ITEE
1st	Analysis and control of functional brain networks	0.2	Prof. Fabio Pasqualetti	University of California, Irvine	SSM
1st	One hundred years of wheel shimmy: Why is it still dangerous?	0.2	Prof. Gabor Stepan	Budapest University of Technology and Economics	CASSYNI
1st	When quantum systems source gravity: how can we do physics without spacetime?	0.2	Prof.Flaminia Giacomini	University of Rome Tor Vergata	SSM
1st	Distributed Kalman filtering for systems with spatiotemporal dynamics	0.2	Dr. Juncal Arbelaiz	Massachusetts Institute of Technology	Autonomy Talk (ETH)
1st	Data-driven complex dynamics	0.2	Prof. Bala Balachandran	University of Maryland	CASSYNI
1st	Intelligent Coordination for Sustainable Roadways – If Autonomous Vehicles are the Answer, then What is	0.2	Prof. Cathy Wu	Massachusetts Institute of Technology	Autonomy Talk (ETH)

	the Question?				
1st	Ricerca e formazione nella società della transizione digitale	1	CINI	CINI	CINI
2nd	An overview of polytopal approximations of partial differential equations	0.2	Daniele Di Pietro	Université de Montpellier	SSM
2nd	IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE Editors	0.3	IEEE	IEEE	IEEE
2nd	IEEE ITSS/CS Young Professionals Webinar: Sensor Synchronization for Sensor Fusion	0.2	IEEE	IEEE	IEEE
2nd	Peaks, Valleys, and Blur: Optimization and Uncertainty Quantification	0.3	CASSYNI	CASSYNI	CASSYNI
2nd	Regolazione in tema di Intelligenza Artificiale alla luce dell'AI ACT	1	5G ACADEMY'S	5G ACADEMY'S	5G ACADEMY'S
2nd	Intelligenza Artificiale e Regole del Mercato	0.4	5G ACADEMY'S	5G ACADEMY'S	5G ACADEMY'S
2nd	Machine Deception	0.2	Dr. Henrik Skaug Sætra	University of Oslo	ICTH
2nd	Generative AI for Software Engineering: Strategies, Impacts, and Practical Application	1	5G ACADEMY'S	5G ACADEMY'S	5G ACADEMY'S
2nd	Social Network Analysis: Methods and Applications	0.4	Prof. Tanmoy Chakraborty	Indian Institute of Technology Delhi	ITEE
2nd	Introduction to Large Language Models: Evolution and the current state	0.4	Prof. Tanmoy Chakraborty	Indian Institute of Technology Delhi	ITEE
2nd	From ACE Technologies to Sustainable, Accessible and Equitable Urban Mobility: An Optimization Journey	0.4	**Prof. Mauro Salazar**	University of Eindhoven	ITEE

Research activities

Over the past three years, I have worked on the development of new methodologies within the Cooperative, Connected and Autonomous Mobility (CCAM) paradigm, which aims to optimize traffic flow and enhance road safety by leveraging vehicle interconnectivity through V2X communication. In this context, I first focused on the design of novel distributed control strategies capable of ensuring high tracking performance for vehicle fleets despite the presence of uncertainties, delays, communication issues (such as Denial-of-Service attacks), or actuator faults. Subsequently, I investigated the impact of different spacing policies on traffic-level behaviours and proposed a new non linear spacing policy capable of optimize the traffic flow but still guarantee the traffic flow stability on the road. Finally, I developed a realistic and reliable Vehicle-in-the-Loop platform to support the validation of control algorithms for connected autonomous vehicles and coordinated vehicle fleets.

Tutoring and supplementary teaching activities

Control Architectures for Autonomous Driving Module: Control Systems for Autonomous Ground Vehicles
Master's degree in Autonomous Vehicle Engineering (MOVE)
ING-INF/04
Tutor: Prof. Stefania Santini
Hours: 30
Credits: 1.2

Credits summary

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1st	19.6	5.4	40	0
2nd	14.2	4.8	41	1.2
3rd	0	0	53.8	0

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
3rd	Technical University of Munich, Munich, Germany	Johannes Betz, Professor	6 months	Research on study and implement innovative neural network architectures based on a model-structured approach. This methodology enables an interpretable decomposition of the neural network components. This line of research led to the publication of a conference paper at ITSC and to the preparation of a journal article, which has recently been submitted.

PhD Thesis

Cooperative, Connected, and Autonomous Mobility (CCAM) represents a cornerstone in the development of Intelligent Transportation Systems (ITS), aimed at deploying services that enhance road safety and optimize traffic performance. In this context, this dissertation contributes by introducing novel control methodologies for autonomous vehicle platoons and by proposing an advanced co-simulation platform for the validation of such systems.

The first part of the work focuses on the design of robust control architectures for connected vehicles, explicitly accounting for the main impairments typical of V2X communications, including delays and DoS attacks, as well as faults occurring in the vehicle actuation systems.

Furthermore, a new spacing policy is proposed, for which a comprehensive stability analysis is provided. The impact of this spacing policy on traffic performance is then quantified through simulations, highlighting how it affects traffic flow capacity and stability.

The second part of the dissertation addresses another fundamental requirement of the CCAM paradigm: the validation of connected and automated driving functionalities. A Vehicle-in-the-Loop (ViL) platform is therefore presented, designed to provide a realistic, synchronized, and reproducible representation of test scenarios. The platform integrates a complete autonomous driving stack coupled with a high-fidelity digital twin that replicates the dynamics, sensors, and behavior of the real vehicle within the virtual environment.

The validation results obtained on selected ADAS functionalities demonstrate the capability of the platform.

The final chapter reports the experimental tests conducted on proving grounds, which confirm the effectiveness of the proposed methodologies and the realism of the ViL framework.

Overall, the work provides significant contributions both in the control domain and in the validation domain, strengthening the foundations required for the deployment of future CCAM services within next-generation ITS ecosystems.

Research products

List of scientific publications

International journal papers

1. Renato Brancati,Giandomenico Di Massa, Aniello Mungiello, Stefano Pagano, Alberto Petrillo, Stefania Santini,
   Semi-active control architecture for MRE-based structure vibration isolation systems via combined Long–Short-Term-Memory and predictive control,
   Mechanical Systems and Signal Processing,
   237, 113095, 2025, DOI: 10.1016/j.ymssp.2025.113095

2. Aniello Mungiello, Felix Jahncke, Stefania Santini, Johannes Betz, Gastone Pietro Rosati Papini, Mattia Piccinini,
   Model-Structured Neural Networks for Vehicle Dynamics Learning Near the Limits,
   Vehicle System Dynamics,
   Under Review

3. Aniello Mungiello, Alberto Petrillo, Stefania Santini,
   Self-driving System Architecture for the UniNa Racing Vehicle Gaiola: Design, Implementation and Experimental Validation,
   Intelligent Transportation System Magazine,
   Under Review

4. Angelo Coppola,Aniello Mungiello,Alberto Petrillo,Stefania Santini,
   On the Effectiveness of a Formation Control for CAV Platoons Under Nonlinear Spacing Policy and Heterogeneous Communication Delays,
   Transportation Research Interdisciplinary Perspectives,
   Under Review

International conference papers

1. Bianca Caiazzo, Dario Giuseppe Lui, Aniello Mungiello, Alberto Petrillo, Stefania Santini,
   On the resilience of Autonomous Connected Vehicles Platoon Under DoS Attacks: a predictor based sampled data control,
   IEEE International Conference on Intelligent Transportation Systems *(ITSC)*,
   Bilbao, Spain, Set. 2023, pp. 4907-4912, DOI: 10.1109/ITSC57777.2023.10421907.

2. Bifulco, Gennaro Nicola, Coppola, Angelo, Mungiello, Aniello , Petrillo, Aalberto, & Santini, Stefania, CAVs platoons under nonlinear spacing policy and heterogeneous communication delays as a formation control problem,
   European Control Conference (ECC),
   Stockholm, Sweden, June. 2024, pp. 1393-1398, DOI: 10.23919/ECC64448.2024.10591125

3. Dario Giuseppe Lui, Aniello Mungiello, Alberto Petrillo, Stefania Santini,
   Distributed Resilient Super-Twisting Sliding Mode Control for Uncertain Heterogeneous Nonlinear CAVs platoons undergoing Bias Actuators Faults and Malicious Attacks,
   IEEE International Conference on Intelligent Transportation Systems (ITSC),
   Gold Coast, Australia, November 2025, To Appear

4. Mattia Piccinini, Aniello Mungiello, Georg Jank, Gastone Pietro Rosati Papini,Francesco Biral, Johannes Betz,
   Model-Structured Neural Networks to Control the Steering Dynamics of Autonomous Race Cars,
   IEEE International Conference on Intelligent Transportation Systems (ITSC),
   Gold Coast, Australia, November 2025, To Appear

5. Angelo Coppola, Aniello Mungiello, Gianmarco Pane, Alberto Petrillo, Stefania Santini,
   On the Virtual Testing of ADAS in CCAM environment via Vehicle-in-the-Loop framework,
   11th IFAC Symposium on Advances in Automotive Control AAC 2025:
   Eindhoven, Netherlands, 16-18 June 2025, DOI: https://doi.org/10.1016/j.ifacol.2025.07.097

Patents and/or spin offs

Awards and Prizes

Young Author Award (Finalist) *at the 11th IFAC Symposium on Advances in Automotive Control AAC 2025 for the paper* "On the Virtual Testing of ADAS in CCAM environment via Vehicle-in-the-Loop framework"

Best poster award *at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) for the poster* "Model-Structured Neural Networks to Control the Steering Dynamics of Autonomous Race Cars"

Date 16/12/2025

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Supervisor signature _____