

Open challenges, future directions, and extended discussion

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Half-day Tutorial Session at ICUAS 2026 (09:00 – 13:00), 15th June 2026
Room Calypso A – Divani Corfu Palace

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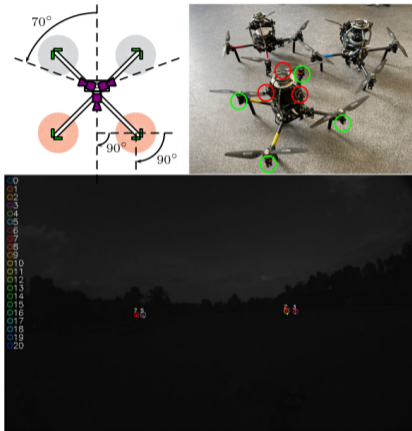
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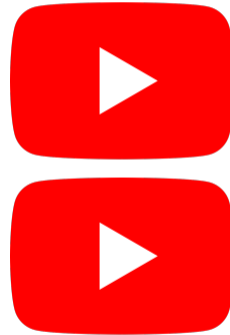


- **Interdisciplinarity is essential:** communications-aware robotics requires balancing both robotics and communication aspects to avoid oversimplification.
- **Channel modeling matters:** the communication channel is the main bridge between motion planning and communication performance.
- **Antenna orientation is critical:** in RF systems, optimizing orientation can drastically improve link quality and robustness.
- **Platform choice matters:** u-MRAVs and f-MRAVs offer very different capabilities in trajectory shaping and antenna alignment.
- **No “one-size-fits-all” model:** the right level of abstraction depends on the scenario (indoor/outdoor, RF/FSO, static/dynamic).

- **Trajectory planning under misalignment:** design strategies for high-gain antennas and FSO systems, where even small angular errors can break the link.
- **Airframe–antenna interaction:** account for aerodynamic and structural effects of the UAV body on antenna radiation patterns.
- **Resilience to adversaries:** develop countermeasures against jamming, GPS spoofing, and other malicious attacks.
- **Multi-agent scalability:** extend planning frameworks to swarms with decentralized coordination and relay selection.
- **Experimental validation:** close the loop between theoretical models, simulation studies, and field experiments.



Optical communication/localization for multi-UAV systems based on camera



D. Bonilla Licea et al., “*Optical communication-based identification for multi-UAV systems: theory and practice*”, Autonomous Robots, 2025.

Communications-Aware Trajectory Planning for Robots: Tutorial

 **D. Bonilla Licea, M. Ghogho, and M. Saska**

When Robotics Meets Wireless Communications: An Introductory Tutorial

Proceedings of the IEEE, 112(2), 140–177, 2024

 **W. Hurst, S. Evmorfos, A. Petropulu, and Y. Mostofi**

Uncrewed Vehicles in 6G Networks: A Unifying Treatment of Problems, Formulations, and Tools

Proceedings of the IEEE, 2025

 **D. Bonilla Licea, G. Silano, H. El Hammouti, M. Ghogho, and M. Saska**

Reshaping UAV-Enabled Communications with Omnidirectional Multi-Rotor Aerial Vehicles

IEEE Communications Magazine, 63(5), 94–100, 2025

Applications of f-MRAV in Communications Networks



D. Bonilla Licea, G. Silano, M. Ghogho, and M. Saska

Omnidirectional Multi-Rotor Aerial Vehicle Pose Optimization: A Novel Approach to Physical Layer Security

IEEE International Conference on Acoustics, Speech, and Signal Processing, 9021–9025, 2024



D. Bonilla Licea, H. El Hammouti, G. Silano, and M. Saska

Harnessing the Potential of Omnidirectional Multi-Rotor Aerial Vehicles in Cooperative Jamming Against Eavesdropping

IEEE Global Communications Conference, 2052–2058, 2024



D. Bonilla Licea, H. El Hammouti, G. Silano, and M. Saska

Harnessing the Potential of Omnidirectional UAVs in RIS-Enabled Wireless Networks

IEEE International Conference on Acoustics, Speech, and Signal Processing, 1–5, 2025



G. Silano, D. Bonilla Licea, H. El Hammouti, and M. Saska

Free-Space Optical Communication-Driven NMPC Framework for Multi-Rotor Aerial Vehicles in Structured Inspection Scenarios

IEEE International Conference on Systems, Man, and Cybernetics, 2025

Influential Papers in Communications-Aware Robotics



B. Li, Z. Fei, and Y. Zhang

UAV Communications for 5G and Beyond: Recent Advances and Future Trends
IEEE Internet of Things Journal, 6(2), 2241–2263, 2019



Y. Zeng, Q. Wu, and R. Zhang

Accessing From the Sky: A Tutorial on UAV Communications for 5G and Beyond
Proceedings of the IEEE, 107(12), 2327–2375, 2019



M. Mozaffari, W. Saad, M. Bennis, Y. Nam, and M. Debbah

A Tutorial on UAVs for Wireless Networks: Applications, Challenges, and Open Problems
IEEE Communications Surveys & Tutorials, 21(3), 2334–2360, 2019



G. Geraci, A. Garcia-Rodriguez, A. M. Mahdi, A. Lozano, M. Mezzavilla, S. Chatzinotas, Y. Chen, S. Rangan, and M. Di Renzo

What Will the Future of UAV Cellular Communications Be? A Flight From 5G to 6G
IEEE Communications Surveys & Tutorials, 24(3), 1304–1335, 2022

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Thank you

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