Viswa Narayanan Sankaranarayanan

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Research Interest

Nonlinear Control	Robust, adaptive, and constrained control for uncertain and delayed systems.
Formal Guarantees	Control barrier function (CBF) safety for RL policy deployment.
Dynamic Coordination	Coordinated control of legged robots and aerial manipulators.
Shared Teleoperation	Hierarchical shared control for remote inspection and telemanipulation.

Education

Dec 2021 – Feb 2026 **Luleå University of Technology, Sweden**
PhD in Robotics and Control Engineering
- **Funding:** *Marie Skłodowska-Curie Early Stage Research Fellowship (ITN)*
- **Dissertation Title:** *Barrier Functions for Deliberate Contact Applications*
- **Research Group:** *Robotics and Artificial Intelligence*
- **Department:** *Computer Science, Electrical and Space Engineering*
- **Key Courses:** *Adaptive Nonlinear Control, Biorobotics, Advanced Robotics*

July 2019 – May 2021 **International Institute of Information Technology, Hyderabad, India**
MS (by Research) in Electronics and Communication Engineering
- **Funding:** *IIIT Hyderabad Research Fellowship*
- **Thesis Title:** *Adaptive Controllers for Quadrotors Carrying Unknown Payloads*
- **Research Group:** *Robotics Research Center*
- **GPA: 9.6/10.0**
- **Key Courses:** *Robotics: Dynamics and Control, Advances in Robotics and Control, Mobile Robotics, Statistical Methods in AI, Topics in Applied Optimization.*

Aug 2011 – May 2015 **SRM Institute of Science and Technology, Chennai, India**
BE in Electronics and Instrumentation Engineering
- **Department:** *Electronics and Instrumentation Engineering*
- **GPA: 8.65/10.0**
- **Key Courses:** *Control Systems, Modern Control Systems, Robotics and Automation, Industrial Instrumentation, Digital Signal Processing, Industrial Automation.*

Work Experience

Oct 2024 – Nov 2024 **Visiting Researcher | Ericsson Research**
- Developed and validated a control solution ensuring the *safety and stability* of *networked robotic systems* in the presence of *delays*.

May 2023 – July 2023 **Visiting Researcher | Technical University of Denmark**
- Led the system integration, control design, and field evaluation for *vision-based target identification, localization, and navigation for aerial robots for payload transportation* between surface vehicles in *GNSS-denied environments*.

Work Experience (continued)

Jan 2019 – Jul 2021 **Research Assistant | IIIT, Hyderabad**

- Performed *LIDAR-based SLAM and path planning* for autonomous navigation in unknown environments.
- Formulated and validated *adaptive robust controllers* to tackle the unmodeled payload dynamics and disturbance rejection for *aerial payload transportation*.

Nov 2015 – May 2018 **Software Engineer | KPIT Technologies**

- Developed and integrated *inter-ECU communication and diagnostic modules* for automotive projects *(ADAS)* using AUTOSAR standards.

Research Publications

Journal Articles

1. **Sankaranarayanan**, **V. N.**, Banerjee, A., Satpute, S., & Nikolakopoulos, G. (2025). Safe docking of a payload-carrying spacecraft using state constrained adaptive control. *Control Engineering Practice (**CEP**), 162*, 106363. doi:10.1016/j.conengprac.2025.106363
2. Saradagi, A., **Sankaranarayanan**, **V. N.**, Banerjee, A., Satpute, S., & Nikolakopoulos, G. (2025). Switched control barrier functions-based safe docking control strategy for a planar floating platform. *Control Engineering Practice (**CEP**), 158*, 106274.
3. **Sankaranarayanan**, **V. N.**, Banerjee, A., Satpute, S., Roy, S., & Nikolakopoulos, G. (2023). Adaptive control for a payload carrying spacecraft with state constraints. *Control Engineering Practice (**CEP**), 135*, 105515.
4. **Sankaranarayanan**, **V. N.**, Satpute, S., & Nikolakopoulos, G. (2022). Adaptive robust control for quadrotors with unknown time-varying delays and uncertainties in dynamics. *Drones, 6*(9), 220.
5. **Sankaranarayanan**, **V. N.**, Yadav, R. D., Swayampakula, R. K., Ganguly, S., & Roy, S. (2022). Robustifying payload carrying operations for quadrotors under time-varying state constraints and uncertainty. *IEEE Robotics and Automation Letters (**RAL**), 7*(2), 4885–4892.
6. Roy, S., Baldi, S., Li, P., & **Sankaranarayanan**, **V. N.** (2020). Artificial-delay adaptive control for under-actuated euler-lagrange robotics. *IEEE/ASME Transactions on Mechatronics, (**TMECH**).*
7. **Sankaranarayanan, V. N.**, & Roy, S. (2020). Introducing switched adaptive control for quadrotors for vertical operations. *Optimal Control Applications and Methods, 2020 (**OCAM**).*

Conference Proceedings

1. Seisa, A. S., **Sankaranarayanan**, **V. N.**, Damigos, G., Satpute, S. G., & Nikolakopoulos, G. (2025). Cloud-assisted remote control for aerial robots: From theory to proof-of-concept implementation. In *2025 ieee 25th international symposium on cluster, cloud and internet computing workshops (ccgridw)* (pp. 171–176). IEEE.
2. Berra, A., **Sankaranarayanan**, **V. N.**, Seisa, A. S., Mellet, J., Gamage, U. G., Satpute, S. G., … Fumagalli, M. et al. (2024). Assisted physical interaction: Autonomous aerial robots with neural network detection, navigation, and safety layers. In *2024 international conference on unmanned aircraft systems (**ICUAS**)* (pp. 1354–1361). IEEE.
3. Mellet, J., Berra, A., Seisa, A. S., **Sankaranarayanan**, **V. N.**, Gamage, U. G., Soto, M. Á. T., … Ruggiero, F. (2024). Design of a flexible robot arm for safe aerial physical interaction. In *2024 ieee 7th international conference on soft robotics (robosoft)* (pp. 1048–1053). IEEE.

4 **Sankaranarayanan**, **V. N.**, Saradagi, A., Satpute, S., & Nikolakopoulos, G. (2024a). A cbf-adaptive control architecture for visual navigation for uav in the presence of uncertainties. In *2024 ieee international conference on robotics and automation (**ICRA**)* (pp. 13659–13665). doi:10.1109/ICRA57147.2024.10611530

5 **Sankaranarayanan**, **V. N.**, Saradagi, A., Satpute, S., & Nikolakopoulos, G. (2024b). Collision-free landing of multiple uavs on moving ground vehicles using time-varying control barrier functions. In *2024 american control conference (**ACC**)* (pp. 3760–3767). IEEE.

6 **Sankaranarayanan**, **V. N.**, Saradagi, A., Satpute, S., & Nikolakopoulos, G. (2024c). Time-varying control barrier function for safe and precise landing of a uav on a moving target. In *2024 ieee/rsj international conference on intelligent robots and systems (**IROS**)* (pp. 8075–8080). IEEE.

7 **Sankaranarayanan**, **V. N.**, Satpute, S., Roy, S., & Nikolakopoulos, G. (2023). Adaptive control of euler-lagrange systems under time-varying state constraints without a priori bounded uncertainty. In *22nd world congress of the international federation of automatic control* (Vol. 56, pp. 3360–3365). Elsevier.

8 Ganguly, S., **Sankaranarayanan**, **V. N.**, Suraj, B., Yadav, R. D., & Roy, S. (2021). Efficient manoeuvring of quadrotor under constrained space and predefined accuracy. In *2021 ieee/rsj international conference on intelligent robots and systems (**IROS**)* (pp. 6352–6357). IEEE.

9 **Sankaranarayanan**, **V. N.**, Roy, S., & Baldi, S. (2020). Aerial transportation of unknown payloads: Adaptive path tracking for quadrotors. In *2020 ieee/rsj international conference on intelligent robots and systems (**IROS**)* (pp. 7710–7715). doi:10.1109/IROS45743.2020.9341402

Projects

2021 – 2024 **Marie-Sklodowska-Curie ITN - ETN Project**, Early Stage Researcher

AERO-TRAIN, *Aerial robot deployment for infrastructure inspection and maintenance.*

- Designed and deployed safe, adaptive, and delay-tolerant controllers for aerial payload transportation, manipulation, and deliberate contact applications.
- Performed vision-based safe landing of UAV on moving targets.
- Developed and tested CBF-based hierarchical control design for teleoperation of UAVs.

2022 – present **EU Horizon Research and Innovation Projects**, Ph.D. Researcher

PERSEPHONE, *Autonomous exploration and extraction of deep mineral deposits*

- Implemented CBF-based reactive controllers for heterogeneous multi-robot navigation in constrained environments.

AMBITIOUS, *Autonomous UAV missions for IoT sensor data collection and operation*

- Developed a safe, scalable, delay-tolerant control architecture for coordinating heterogeneous multi-agents.

SPEAR, *Aerial robot generation with unique morphologies andsuperior performance*

- Experimentally validated RL-based control algorithms on UAVs and developed a safety-focused architecture for deploying and testing these policies.
- Enhancing long-range aerial navigation and remote inspection in forest environments using onboard sensors and safety-critical control.

M4Mining, *New, sustainable, profitable, and resilient workflows for mining environments*

- Deployed safe reactive control for aerial exploration and visualization of mines.

NEXGEN SIMS, *Efficient, safe, and sustainable mining*

- Enabled autonomous visual inspection and gas measurement through safe control design for aerial and ground vehicles.

Projects (continued)

2022 – 2023 **Industrial Project**, Ph.D. Researcher
SP 14, *Sustainable Underground Mining (LKAB)*
- Field evaluation of reactive controller for mine and shaft inspection using UAVs.

Workshops and Tutorials

Workshop at ICUAS 2024 Co-organized a full day workshop on Aerial Workers for Infrastructure and Asset Maintenance: The journey from "Lab" to "Real-World".

Tutorial at ICUAS 2024 Presented a tutorial on "Robust and adaptive control techniques for UAVs for disturbance rejection, and safety guarantees through barrier functions".

Summer School 2024 Co-organized the three-day AEROTRAIN summer school on aerial robotics and conducted a hands-on tutorial on Network Controlled Systems.

Thesis

Masters Thesis (2021): *Adaptive Controllers for Quadrotors Carrying Unknown Payloads*, Advisors: Spandan Roy, K. Madhava Krishna, IIIT Hyderabad, India.

Licentiate Thesis (2023): *Adaptive control for robots to handle uncertainties, delays and state constraints*, Supervisors: George Nikolokopoulos, Sumeet Satpute, LTU, Sweden.

Teaching Experience

Lecturing

2025 **Spacecraft Guidance, Navigation and Control** (R7030R) at LTU, Luleå, Sweden: *Conducting the space lab exercises using a space-robotic platform.*

Advanced Robotics (R7021E) at LTU, Luleå, Sweden: *ROS2, Gazebo, and Turtlebot-based lab-work and assignment preparation, conducting the simulation and hardware lab exercises, and assignment evaluation.*

Biorobotics (R7017E) at LTU, Luleå, Sweden: *ROS2, Gazebo, and quadruped-based lab-work and assignment preparation, conducting the simulation and hardware lab exercises, and assignment evaluation.*

2024 **Spacecraft Guidance, Navigation and Control** (R7030R) at LTU, Luleå, Sweden: *Conducting the space lab exercises using a space-robotic platform.*

Biorobotics (R7017E) at LTU, Luleå, Sweden: *Lecture, lab-work, and assignment preparation, conducting the lab exercises and assignments evaluation.*

Biorobotics (R7010E) at LTU, Luleå, Sweden: *Lab-work and assignment evaluation.*

2023 **Spacecraft Guidance, Navigation and Control** (R7030R) at LTU, Luleå, Sweden: *Conducting the space lab exercises using a space-robotic platform.*

Robotics (R7010E) at LTU, Luleå, Sweden: *Lab-work and assignment evaluation.*

2021 **Advances in Robotics and Control** (EC4.501) at IIIT, Hyderabad, India: *Quizzes and assignments: preparation and evaluation.*

2020 **Robotics: Dynamics and Control** (EC4.401) at IIIT, Hyderabad, India: *Quizzes and assignments: preparation and evaluation.*

Master Thesis Supervision

2025 **Donald Låås** *Control effort-optimal Model Predictive Control for space docking with acceleration-based terminal orientation constraint*

2024 **Federico Gatti** *Ensuring safe docking maneuvers on floating platform using Nonlinear Model Predictive Control (NMPC)*

Teaching Experience (continued)

2023 **Manpreet Lotte** *Modelling, Control and Vision-Based Docking of an Autonomous Underwater Vehicle*
Maxime Zufferey *UAV Navigation & Object Detection in a GNSS-denied Environment*

Computer Skills

Languages	Proficient in English, Tamil, and Hindi.
Programming Languages	C, C++, Python, Docker, XML, MATLAB
Robotics Framework	ROS, ROS 2, Gazebo, PX4
GUI Framework	Qt, QML
Communication Protocol	CAN, Ethernet

Miscellaneous Experience

Other Research Experience

2021 – Present **MBZIRC | PhD Researcher | LTU, Sweden**
Safe autonomous inspection, landing, and payload transportation using aerial and surface robots, using adaptive safety-critical control and onboard system monitoring.

Awards and Achievements

2021–2024 **Marie Skłodowska-Curie Early Stage Research Fellowship**, Awarded a prestigious EU Innovative Training Network (ITN) fellowship to support my doctoral research.

2019-2021 **IIIT Hyderabad research fellowship**, Awarded a fellowship to cover tuition and living expenses during my Masters.

2024 **MBZIRC'23**, One of the five MBZIRC Maritime Grand Challenge finalists.

2022 **ARTPARK Robotics Challenge**, Runners up at ARTPARK Robotics Challenge 2021-2022.

2015 **RoboGames'15**, Won Bronze Medal in FreeStyle.

Volunteering and Outreach

2020-Present Reviewer for TMECH, IROS, ICRA, CASE, ACSP, JINT, L-CSS, CDC, CEP, and other esteemed conferences and journals.

2013-Present Pedagogy developer for Talent Quest for India Trust.

2016-2018 Coordinator of Chhote Scientists, a CSR initiative by KPIT Technologies.

References

Prof. George Nikolokopoulos
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