Pavel Petráček

Czech Technical University In Prague
Department of Cybernetics
Multi-Robot Systems group
✉ *pavel.petracek@fel.cvut.cz*
mrs.felk.cvut.cz/pavel-petracek
GitHub *Google Scholar*
CV updated on June 15, 2022

Education

2019–present **Pursuing Ph.D. in Informatics**, Department of Cybernetics, Faculty of Electrical Engineering, Czech Technical University in Prague (FEE CTU).
— **general research on:** lightweight yet robust localization and mapping of mobile robots in perception-degraded environments, decentralized swarming systems, robustness maximization in aerial robotics
— 8 publications in impacted journals and 3 contributions to conference proceedings since 2019
— **h-index**: 3 in WoS, 6 in Google Scholar, **citations count**: 27 in WoS, 76 in Google Scholar (39 in 2021)
— supervisor: doc. Ing. Martin Saska, Dr. rer. nat.

2017–2019 **Ing. (= Master of Science), Cybernetics and robotics**, FEE CTU.

2014–2017 **Bc. (= Bachelor of Science), Cybernetics and robotics**, FEE CTU.

Experience

2019–present **Research fellow at Multi-Robot Systems group**, FEE CTU.
— **responsibilities:** general research, co-development of MRS UAV system, transferring research ideas into the real-world (design and realization of robotic experiments, participation in robotic competitions), robotic demos for investors, students and public media, supervision of students, popularization of the university and the field, academic courses & summer school preparations, workshop organization

Research projects & competitions

2020–2022 **DARPA Subterranean Challenge**, Exploration of unknown subterranean environments with a cooperative team of ground and aerial autonomous robots.
— **contributions & responsibilities:** Development of novel methods of lightweight perception, localization, and mapping of UAVs in perception-degraded environments, UAV system design, real-time systems integration, system evaluation and testing, key member for in situ deployment of aerial robots. Research published in several journal publications.

2018–present **Dronument**, Documentation of interiors of historical structures with autonomous aerial robots.
— **contributions & responsibilities:** Development of a robust HW & SW system capable of deploying a fully autonomous UAV team within interiors of historical structures. Focus on on-board UAV localization and prevention of its degeneracy in geometrically featureless environments. Deployment of the system for documenting 17 historical objects (including Chateau Kromeriz from the UNESCO heritage database) with direct use for heritage preservation. Research published in several journal publications.

2017-present **Swarming**, Decentralized control of UAV teams in obstacle-filled environments.
— **contributions:** Novel bio-inspired algorithms for communication-less perception-aware coordination of UAV teams in environments with obstacles. Research published in several academic publications.

2020-present **DOFEC**, Extinguishment of fires in aboveground floors using an autonomous UAV.
— **contributions:** detection and localization of fires from on-board sensors, mission planning

Industry

2016-2017 **Software testing**, *CertiCon a.s.*, Learned how to properly think about and write automated software tests. Gained experience in corporate project management and scheduling.

2012-2014 **Robotic automation**, *KD planeta s.r.o.*, First-hand experience with robotic automation — interaction between human operators, robotic manipulators, and CNC machinery.

Honors & awards

2021 **DARPA Subterranean Challenge**, Part of team CTU-CRAS-NORLAB competing with well-known foreign universities and companies (e.g., Caltech, MIT, ETH Zürich) in multi-robot search & rescue operations in underground environments.
— 1st place among non-funded teams in the Urban Circuit, real-world deployment ($500k)
— 2nd place among all teams in the Final Round, virtual deployment ($500k)

2019 **Dean's price for astounding Master thesis**, FEE CTU. Related to the Dronument project.
— topic: Design, localization and position control of a specialized UAV platform for documentation of historical monuments

2017 **Dean's price for astounding Bachelor thesis**, FEE CTU.
— topic: Decentralized model of a swarm behavior Boids in ROS
— contributions: Novel research on decentralized control of a UAV team in obstacle-filled environments. Results published in journal Bioinspiration & Biomimetics.

Peer-reviewed publications

Journal articles

- **P. Petracek**, V. Kratky, M. Petrlik, T. Baca, R. Kratochvil, and M. Saska, "Large-Scale Exploration of Cave Environments by Unmanned Aerial Vehicles," *IEEE Robotics and Automation Letters*, vol. 6, no. 4, pp. 7596–7603, Oct. 2021, **IF 3.74, Q2 in Robotics**.
- **P. Petracek**, V. Kratky, and M. Saska, "Dronument: System for Reliable Deployment of Micro Aerial Vehicles in Dark Areas of Large Historical Monuments," *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 2078–2085, Apr. 2020, **IF 3.74, Q2 in Robotics**.
- **P. Petracek**, V. Walter, T. Baca, and M. Saska, "Bio-inspired compact swarms of unmanned aerial vehicles without communication and external localization," *Bioinspiration & Biomimetics*, vol. 16, no. 2, p. 026 009, Dec. 2020, **IF 2.96, Q2 in Robotics**.
- V. Kratky, **P. Petracek**, V. Spurny, and M. Saska, "Autonomous Reflectance Transformation Imaging by a Team of Unmanned Aerial Vehicles," *IEEE Robotics and Automation Letters*, vol. 5, no. 2, pp. 2302–2309, Apr. 2020, **IF 3.74, Q2 in Robotics**.
- V. Kratky, **P. Petracek**, T. Baca, and M. Saska, "An autonomous unmanned aerial vehicle system for fast exploration of large complex indoor environments," *Journal of Field Robotics*, vol. 38, no. 8, pp. 1036–1058, May 2021, **IF 3.77, Q2 in Robotics**.
- V. Kratky, **P. Petracek**, T. Nascimento, M. Cadilova, M. Skobrtal, P. Stoudek, and M. Saska, "Safe Documentation of Historical Monuments by an Autonomous Unmanned Aerial Vehicle," *ISPRS International Journal of Geo-Information*, vol. 10, no. 11, Oct. 2021, **The first two authors had contributed equally. IF 2.90, Q2 in Computer Science (Information Systems)**.
- F. Novak, V. Walter, **P. Petracek**, T. Baca, and M. Saska, "Fast collective evasion in self-localized swarms of unmanned aerial vehicles," *Bioinspiration & Biomimetics*, vol. 16, no. 6, p. 066 025, Nov. 2021, **IF 2.96, Q2 in Robotics**.
- T. Roucek, M. Pecka, P. Cizek, T. Petricek, J. Bayer, V. Salansky, T. Azayev, D. Hert, M. Petrlik, T. Baca, V. Spurny, V. Kratky, **P. Petracek**, D. Baril, M. Vaidis, V. Kubelka, F. Pomerleau, J. Faigl, K. Zimmermann, M. Saska, T. Svoboda, and T. Krajnik, "System for multi-robotic exploration of underground environments CTU-CRAS-NORLAB in the DARPA Subterranean Challenge," *Accepted to Field Robotics*, vol. abs/2110.05911, 2021, **Preprint**.

Conference articles

- T. Amorim, T. Nascimento, **P. Petracek**, G. de Masi, E. Ferrante, and M. Saska, "Self-Organized UAV Flocking Based on Proximal Control," in *ICUAS*, 2021, pp. 1374–1382.
- D. Hert, T. Baca, **P. Petracek**, V. Kratky, V. Spurny, M. Petrlik, V. Matous, D. Zaitlik, P. Stoudek, V. Walter, P. Stepan, J. Horyna, V. Pritzl, G. Silano, D. Bonilla Licea, P. Stibinger, R. Penicka, T. Nascimento,

and M. Saska, "MRS Modular UAV Hardware Platforms for Supporting Research in Real-World Outdoor and Indoor Environments," in *ICUAS*, Jun. 2022.

- A. Ahmad, V. Walter, **P. Petracek**, M. Petrlik, T. Baca, D. Zaitlik, and M. Saska, "Autonomous Aerial Swarming in GNSS-denied Environments with High Obstacle Density," in *IEEE ICRA*, 2021, pp. 570–576.

Secondary academic activities

Workshop presentations:

- Decentralized Aerial Swarms Using Vision-Based Mutual Localization, *In IEEE IROS (Second Workshop on Multi-robot Perception-Driven Control and Planning)*, 2018.

Referee for journals and conference proceedings: Transactions on Cybernetics, Robotics and Automation Letters, International Conference on Robotics and Automation, International Conference on Intelligent Robots and Systems.

Supervised students

Bc. **Vojtěch Nydrle**, Cybernetics and robotics, FEE CTU.
— thesis: Design of a specialized UAV platform for the discharge of a fire extinguishing capsule
— awarded with the Dean's price for astounding Bachelor thesis

Martin Fischer, Cybernetics and robotics, FEE CTU.
— thesis: Lidar and multi-camera calibration and fusion
— awarded with the Dean's price for astounding Bachelor thesis