Collision Resilient Navigation for Aerial Robots in Confined Environments

Project goal: This research aims to enhance the navigation abilities of aerial robots in confined/narrow environments by enabling them to stably establish contact with surfaces of their environment. More specifically, a Micro Aerial Vehicle will be enhanced with specialized mechanisms for physical interaction (extensions) and a software framework for control in confined spaces by exploiting contact. Force feedback at the end effectors will facilitate stable and sustainable physical interaction. This research direction plans to radically change how flying robots navigate through narrow environments such as ore-passes or manholes.

Research Tasks:

- Literature review on aerial robotic physical interaction
- Outline of general methodology for contact-enhanced navigation
- Design of the mechatronic enhancement for a Micro Aerial Vehicle (through the use of carbon fiber material and 3D printing techniques)
- Design of the physical interaction Control framework
- Integration onboard a Pixhawk (open-source autopilot)-based hexarotor that further integrates an INTEL NUC i7, visible-light cameras and an Inertial Measurement Unit
- Experimental evaluation in the lab

Required Skills:

- Good understanding of dynamics and control
- Basic experience in 3D CAD
- Experience in C++ programming
- Experience with Robot Operating System (ROS)
- Background in control theory

Contact Details:

If you are interested in this project, please send you transcripts and CV to Dr. Kostas Alexis (kalexis@unr.edu) or Dr. Christos Papachristos (cpapachristos@unr.edu).