

Department of Mechanical Engineering
University of Thessaly
Seminar on Tuesday, June 11, 2024, at 1pm

Title: Aerial Robotics for Advanced Sensing Applications

Speaker: Dr. Nikos Vitzilaios, Associate Professor, Department of Mechanical Engineering, University of South Carolina, Columbia, SC, USA, vitzilaios@sc.edu, <https://usrl-uofsc.github.io>

Abstract

Uncrewed Aircraft Systems (UAS, widely known as aerial drones) have been significantly developed in the last decade and are increasingly used in time-consuming and effort-heavy scientific exploration applications. While these systems are widely accessible due to low cost and ease of use, they still suffer from limited flight time and payload capabilities. As a result, most of the commercial small scale UAS are exclusively used as flying cameras, in applications where some kind of visual inspection is needed. Moreover, modern commercial autopilots allow the use of these systems from anyone, even without any experience, but without offering any customization capabilities that may be required in some applications.

In this talk, we present the work performed in the Unmanned Systems & Robotics Lab (USRL) at the University of South Carolina. Our goal is to develop autonomous aircraft systems that go beyond traditional visual inspections and address advanced sensing applications in various domains. Our goal is to develop customized UAS with increased payload capabilities that carry various sensors (modular systems), interact with the environment, and have customized control features not typically included in the commercial autopilot applications. We present the design, development and experimental validation\implementation of several UAS built to address the following applications:

- UAS-based vibration monitoring and structural health assessment of bridges.
- Railroad infrastructure structural health monitoring using UAS-based Digital Image Correlation (DIC).
- UAS-based railroad line tracking and following, including traversability assessment.
- UAS-based sensing and targeted sampling in aquatic ecosystems.

Moreover, our work in the area of robotic perception using fiducial markers will be presented, as well as the implementation of a marsupial robotic system that combines an aerial and a marine robot for increased autonomy in marine applications.

Biography

Dr. Nikos Vitzilaios is an Assistant Professor of Robotics in the Department of Mechanical Engineering at the University of South Carolina (UofSC). He is the Director of the Unmanned Systems & Robotics Laboratory (USRL) working on perception, navigation and control of unmanned systems focusing on unmanned aircraft (aerial drones). USRL has a fleet of 30+ aerial drones including commercial, customized, and in-house built systems used in several monitoring/inspection applications. At the UofSC he teaches courses in robotics, control theory, mechatronics and optimal state estimation.

Dr. Vitzilaios has more than 15 years of experience in the field of aerial robotics; he earned his PhD in 2010 (Technical University of Crete, Chania, Greece) working on the autonomous control of small-scale unmanned helicopters. As a Postdoctoral Fellow at the University of Alberta (2011-2012) he worked on nonlinear control of heavy lift unmanned helicopters. As a Research Scientist (2012-2015) at the University of Denver, he worked on a National Science Foundation project on the development and integration of teams of aerial and ground robots. Prior to joining UofSC (2017) he was a Senior Lecturer of Robotics at Kingston University London (United Kingdom) where he was elected a Fellow of the Higher Education Academy.

Dr. Vitzilaios has more than 40 publications in international conferences and journals. His research has been funded by the National Science Foundation (NSF), US Department of Transportation (DOT) and the Federal Railroad Administration (FRA). He is a Senior Member of IEEE (Institute of Electrical and Electronics Engineers), member of ASME, AIAA, AUVSI, IFAC and member of the organizing committee of the annual International Conference on Unmanned Aircraft Systems (ICUAS). He is also a FAA Part 107 sUAS certified pilot and has successfully completed the APSA-NIST Basic Proficiency Evaluation for Remote Pilots.