Modeling and Control of a VTOL UAV Interacting with the Environment: From Flying Vehicles to Flying Robots

In this talk the modeling, control design and prototyping of a Ducted-Fan Miniature Aerial Vehicle interacting with the environment is presented. This research activity is carried out in the context of the European Project AIRobots (www.airobots.eu) that will be briefly presented during the talk. The vision is to develop unmanned aerial vehicles capable to accomplish tasks which may require contacts between the aerial vehicle and the environment such as remote manipulation, docking and flight in cluttered environments. Since the system's dynamics may be dramatically different when contacts happen and when they do not, in the first part of the talk an overall description of the system is obtained by collection of the different behaviors into hybrid automaton. For this particular class of hybrid dynamical system, a general framework for robust control of the system over predefined trajectories is developed and subsequently specialized of the case of the Ducted-Fan interacting with the environment.

In the last part of the talk we present recent research activities involving the control of the Ducted-Fan Aerial Vehicle during the transition maneuver between the hovering flight configuration towards the more efficient level flight configuration. Optimal minimum-time and minimum-energy transition maneuvers and preliminary control results will be presented.
BIO

Dr. Roberto Naldi is currently a Research Assistant at the Department of Electronic, Computer Science and Systems (DEIS) of the University of Bologna where he is working under the supervision of professor Lorenzo Marconi. The main focuses of his research are aerial robotics and nonlinear and robust control.