

RSS 2013 Workshop on Resource-Efficient Integration of Perception, Control and Navigation for Micro Air Vehicles (MAVs)

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Towards Physically Interactive Flying Robots: Physical Action and Human Haptic Control with Micro Aerial Vehicles.

Antonio Franchi (Max Planck Institute for Biological Cybernetics)

Abstract: A primary objective of the "Autonomous Robotics and Human-Machine Systems" group at the "Max Planck Institute for Biological Cybernetics" is the design of new algorithms and architectures aimed at filling the gap between aerial vehicles conceived as pure flying sensors and fully-mature flying robots that are able to deeply interact with the surrounding world. Within this research perspective, the group is currently exploring two main areas. Firstly, we aim at establishing a tight coupling (both haptic and "immersive" in a more generic sense) with human collaborators, that might be also remotely located. Secondly, we are exploring new methodologies to allow a physical and effective action in the flyable space of the MAVs.

The talk will briefly review the consolidated result and also show the more recent preliminary results and directions of research. In particular the following projects will be presented in the talk:

- 1) Shared control and haptic teleoperation of multiple UAVs;
- 2) Synergetic haptic co-planning in cluttered environments;
- 3) Aerial grasping: planning and control of grasping-aware quadrotor trajectories;
- 4) The Flying Hand: a human–hand driven formation of UAVs to grasp and move objects.

Both the theoretical methodologies behind the developed algorithms and the practical application with (multiple) quadrotors will be shown in the talk.

Among the several theoretical methods that are used in these studies in order to tackle the related challenging problems we can mention "passivity-based control" and "graph-theoretical distributed control and estimation".

Biography: Antonio Franchi received the Laurea degree "summa cum laude" in Electronic Engineering in 2005 and the Ph.D. degree in control and system theory in 2009, both from University of Rome La Sapienza, Italy. Since 2010 he is with the Max Planck Institute for Biological Cybernetics, where he is currently a senior research scientist and the Project Leader of the Autonomous Robotics and Human-machine Systems group. He was a visiting student at University of California at Santa Barbara and he is currently serving as an Associate Editor of the IEEE Robotics and Automation Magazine. His main research interests include autonomous systems and robotics, with a special regard to planning, control, estimation, human–machine interaction, haptics, and robotics software architectures.

WebSites:

<http://www.kyb.mpg.de/research/dep/bu/hri/>, <http://antoniofranchi.com/robotics/>