

Locomotion and Manipulation: Unifying Solutions Across Aerial and Terrestrial Regimes

Organizers: D. Pucci, M. Fumagalli, A. Ajoudani, J. Park, P. M. Wensing
https://loc2.github.io/ws_locomotion-manipulation

Objectives

This workshop aims to bring humanoid and flying robots closer, both in their theory of control and in the physical platforms themselves, by encouraging discussion between scientists from humanoid and aerial robotics.

The goal of providing humanoids with capabilities of locomotion and manipulation has driven much recent research in the robotics community. Legged and wheeled locomotion have proven to be feasible on various platforms, supporting a growing envelope of agile ground mobility. Nevertheless, underactuation combined with a large number of degrees-of-freedom commonly challenge the control of locomotion and manipulation in these platforms. With the recent outgrowth of aerial manipulation, these traditionally disparate communities have faced similar challenges.

Thus, this workshop aims to gather scientists towards unifying solutions for challenges in flight, contact locomotion, and manipulation. The envisaged applications belong to the domains of both Whole-Body Loco-Manipulation and Aerial Manipulation.

Historically, control systems for humanoids and flying robots have developed along different paths. Whole-body control of humanoids has addressed high-DoF challenges, but largely has neglected underactuation. Control of aerial vehicles has a strong theoretical underpinning with roots in the control community, providing rigorous methods to address underactuation. Yet, the recent introduction of aerial manipulation has introduced increasingly challenging high-DoF control problems in this domain.

Thus, there is yet strong potential in bringing humanoid and flying robots closer: both in the theory upon which their control is grounded, and physically in the platforms themselves. A system combining aspects of both platforms may have the capacities of flight, contact locomotion, and manipulation. Such future systems would enlarge the application domain of humanoid and aerial robots, inheriting expanded versatility for future deployment in challenging environments.

Topics of interest

- Unified whole-body control of humanoids on ground and in flight
- Aerial manipulation
- Nonholonomy and holonomy in locomotion and manipulation
- Control of angular momentum
- Geometric methods in robot control
- Managing dynamic physical interaction in challenging/uncertain environments

Invited and confirmed speakers

- **Talk topic: locomotion**
 - o Russ Tedrake, MIT
 - o Olivier Stasse, LAAS CNRS
 - o Jaeheung Park, Seoul National University
- **Talk topic: manipulation**
 - o Tamim Asfour, Karlsruhe Institute of Technology
 - o Abderrahmane Kheddar, LIRMM CNRS
 - o Antonio Bicchi, Italian Institute of Technology
- **Talk topic: aerial robots**
 - o Vincenzo Lippiello, Università Federico II di Napoli
 - o Antonio Franchi, LASS CNRS
 - o Koushil Sreenath, UC Berkeley
 - o Lorenzo Marconi, Università di Bologna

Program

Time	Talk
8:30 – 8:45	Introduction by the organisers
8:45 – 9:00	Daniele Pucci, talk on “Towards Aerial Humanoid Robotics”
9:00 – 9:30	Russ Tedrake, talk on “Locomotion”
9:30 – 10:00	Lorenzo Marconi, talk on “Aerial Robots”
10:00 – 10:30	Tamim Asfour, talk on “Manipulation”
10:30 – 11:00	Coffee break
11:00 – 11:30	Two presentations from contributing speakers
11:30 – 12:00	Olivier Stasse, talk on “Locomotion”
12:00 – 12:30	Antonio Bicchi, talk on “Manipulation”
12:30 – 13:00	Vincenzo Lippiello, talk on “Aerial Robots”
13:00 – 14:00	Lunch Break
14:00 – 14:30	Jaeheung Park, talk on “Locomotion”
14:30 – 15:00	Abderrahmane Kheddar, talk on “Manipulation”
15:00 – 15:30	Koushil Sreenath, talk on “Aerial robots”
15:30 – 16:30	Coffee Break and poster session from contributions
16:30 – 17:00	Antonio Franchi, talk on “Aerial robots”
17:00 – 17:15	Arash Ajoudani, talk on “Manipulation”
17:15 – 17:30	Matteo Fumagalli, talk on “Aerial robots”
17:30 – 18:00	Panel Discussion

Organizers

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Plan to solicit the participation

After the acceptance confirmation, we will call for contributions in the research areas listed in the Section “Topic of interest”. We anticipate selecting 20 contributing authors to give two interactive presentations before the lunch break (refer to the Section “Program”). All contributions will be peer-reviewed by at least two experts.

Due to the international association of the workshop organizers (Europe (A. Ajoudani, D. Pucci, M. Fumagalli), United States (P. Wensing), and Asia (J. Park)), the proposed workshop will be widely advertised to the ongoing related projects: Cogimon (7 partners), WALKMAN(5 Partners), SOMA (7 partners), AnDy(9 partners) and AEROWORKS (9 partners). In addition, the organizers’ areas of expertise cover all aspects of the proposed workshop (Manipulation (A. Ajoudani), Terrain Locomotion (P. Wensing, J. Park) and Aerial Manipulation and Locomotion (M. Fumagalli, D. Pucci) that will help encourage relevant discussions in the workshop. We will also advertise the workshop on LinkedIn and ResearchGate to extend the professional social connections, as well as to mailing lists such as *euRobotics*, *robotics-worldwide*, etc. Furthermore, the **following Technical Committees (TC)** have acknowledged full support, especially in advertising the workshop through dedicated channels:

1. **Technical Committee on Robotic Hands, Grasping, and Manipulation**
2. **IEEE-RAS TC on Whole-Body Control**
3. **The IEEE-RAS Technical Committee on Mobile Manipulation**

The workshop will also provide a means to sponsor and attract submissions to the IEEE/RAS Special Issue on Floating-base (Aerial and Underwater) Manipulation (<http://www.ieee-ras.org/publications/ram/ram-special-issues/special-issue-on-floating-base-aerial-and-underwater-manipulation>), with deadline for submission in December 2017. We will

also reach out to the industrial communities to attend the workshop and evaluate the proposed unified solutions.






Dissemination

In the final discussion at the end of the day, we summarize and present the results of the final round table discussion. We will post a document with the content of the final discussion on the workshop webpage. We will offer the participants an opportunity to register their email addresses with us to receive follow-up news such as online proceedings, journal special issue and subsequent workshop organizations in conjunction with this workshop. We will make the contact addresses available on the workshop homepage for those who give explicit consent, which will enable inter-participant discussions to continue after the workshop. We will post the presentations of invited speakers and the papers and presentations of contributing authors on the workshop webpage.

Equipment

The workshop will require an adequate number of video screens or poster boards to support the interactive session. We also request a large room with round tables seating 6-8 people to facilitate round table discussions in the afternoon.

IEEE RAS TC Support Letters

<p>Technical Committee on Robotic Hands, Grasping, and Manipulation</p>  <p>Suwon, 07/28/2017</p> <p>Dear Humanoids 2017 Workshop Chair,</p> <p>It is our pleasure to state the full support of the IEEE-RAS Technical Committee on Robotic Hands, Grasping and Manipulation to the workshop entitled "Towards Whole-Body Aerial Loco-Manipulation," organized by Prof. Matteo Fumagalli, Dr. Daniele Pucci, Dr. Arash Ajoudani, and Prof. Jaehung Park.</p> <p>Yours Sincerely,</p>  <p>Hyungsik Moon</p> <p>(on behalf of Matteo Bianchi, Jeannette Rohé, Robert Platt)</p> <p>Co-Chair of the Technical Committee on Robotic Hands, Grasping and Manipulation</p> <p>Associate Professor</p> <p>School of Mechanical Engineering, Sungkyunkwan University</p> <p>2066 Seoburo, Jangsan-gu, Suwon, Gyeonggi-do 16419 (Korea)</p> <p>hyungsik@skku.edu</p> <p>+82.31.299.4842</p>	<p><p>Letter of support to the Humanoids 2017 workshop proposal: "Towards Whole-Body Aerial Loco-Manipulation"</p><p>Milano, July 27, 2017</p><p>This is to express our support to the workshop "Towards Whole-Body Aerial Loco-Manipulation" proposed for the 2017 IEEE International Conference on Humanoid Robots (Humanoids) to be held on November 2017 in Birmingham, UK.</p><p>The proposed workshop aims to explore the combination of Whole-Body Control techniques and aerial manipulation. Whole-Body Control is at the basis of the topics covered in the workshop, and the proposed applications domain is novel, and potentially very interesting.</p><p>As Co-Chair of the IEEE-RAS Technical Committee on Whole-Body Control, I strongly support the workshop proposal.</p><p>Kind Regards,</p><p>Dr. Eng. Federico L. Moio, PhD</p><p>Co-Chair, IEEE-RAS Technical Committee on Whole-Body Control</p><p>Researcher, National Research Council (CNR) of Italy Institute of Industrial Technologies and Automation (ITIA) Intelligent Robots and Autonomous Systems (IRAS)</p><p>Via Corti 12 - 20133 Milano, Italy - Tel. +39 02 2360 9962 - Fax. +39 02 2360 5929</p></p>	<p>Dear organizers - HUMANOIDS 2017 Workshops and Tutorials Committee</p> <p>The IEEE-RAS Technical Committee on Mobile Manipulation (TCMM) is pleased to share with you that we endorse the HUMANOIDS 2017 workshop proposal on "Locomotion and Manipulation: Unifying Solutions Across Aerial and Terrestrial Regimes", co-organized by Daniele Pucci and Arash Ajoudani from Italian Institute of Technology (Italy), M. Fumagalli from Aalborg University (Denmark), Jaehung Park from Seoul National University (South Korea), and Patrick Wensing from University of Notre Dame (USA).</p> <p>This workshop will bring together experts from three main robotic sub-communities: manipulation, locomotion and aerial manipulation, to present their methods and try to find commonalities that help to efficiently solve the problems arising in the topic of whole-body aerial loco-manipulation. The mixed areas of expertise of the organizers of this workshop and the interesting selection of speakers will surely spark the interest and facilitate the discussions among the attendees.</p> <p>The Technical Committee considers that the workshop proposal is in line with the objectives and activities of the TC, and we believe that it will be of great interest for a large portion of the robotics community. Upon acceptance of the proposal, we will be happy to advertise it through our mailing list, Facebook and LinkedIn groups.</p> <p>Kind regards,</p>  <p>Massimo A. Raa, Co-Chair, TCMM</p> <p>On behalf of the other co-chairs of the TCMM, Mehmet Dogar and Nikolaos Corvellec</p>
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