Remembering
Fabrizio Flacco

Guardiagrele, Italy 25.11.1981
Montpellier, France 18.9.2016

Alessandro De Luca, Sapienza Università di Roma

Academic Biosketch

Fabrizio Flacco

- Sep 2004 – Dec 2007: Master degree
  - cum laude in Automation Engineering from the University of Pisa
- Jan – Oct 2008: Research assistant
  - at the Research Center "E. Piaggio" of the University of Pisa
  - *Methods for motion planning of robots in human presence* (advisor Antonio Bicchi)
- Nov 2008 – Dec 2011: PhD degree
  - at the DIAG Robotics Lab of the Sapienza University of Rome
  - working also on EU FP6 project PHRIENDS
  - *Modeling and control of robots with compliant actuation* (advisor Alessandro De Luca)
- Jan – Jul 2011: Visiting scholar
  - at the Stanford Artificial Intelligence Lab – SAIL (with Oussama Khatib)
- Jan 2012 – Nov 2015: Post-doc
  - at Sapienza University of Rome
  - working on EU FP7 projects SAPHARI and H2020 SYMPLEXITY
- since Dec 2015: CNRS Permanent researcher
  - at the CNRS-LIRMM in Montpellier, in the IDH group (leader Abderrahmane Kheddar)
  - working on EU H2020 project COMANOID

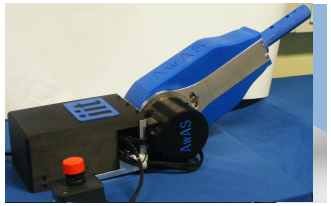
Moving around

Research places and project teams where Fabrizio has worked

Main scientific contributions

Fabrizio Flacco

- Robots with flexible joints or with Variable Stiffness Actuation (VSA)
  - exact **gravity cancellation** on the link side in robots with any flexible transmission type
  - feedback linearization and **simultaneous motion/stiffness control** of VSA-based robots
  - on-line **estimation of joint stiffness** in (serial or parallel) VSA devices



- Human-robot coexistence
  - **optimal sensor placement** for continuous collision avoidance
  - depth-space **efficient distance computation** in dynamic environments (with humans)
- Robots with kinematic redundancy
  - on-line **optimal control under hard constraints** on joint range, velocity, acceleration, and torque: the Saturation in the Null Space (**SNS**) method
  - direct **velocity-level implementation** of control schemes designed at the acceleration level
  - **task priority revisited** for efficiency: the Reverse Priority (**RP**) method
- Safe physical Human-Robot Collaboration
  - a **control architecture** consistently handling **safety**, **coexistence** and **collaboration** in HRI
  - sensor-less **collision detection**, isolation and robot reaction (residual method)
  - concept of physical interaction control at a **generalized contact level**
- Publications: www.lirmm.fr/users/utilisateurs-lirmm/fabrizio-flacco/publication

Early work in Pisa

Fabrizio's master thesis and beyond

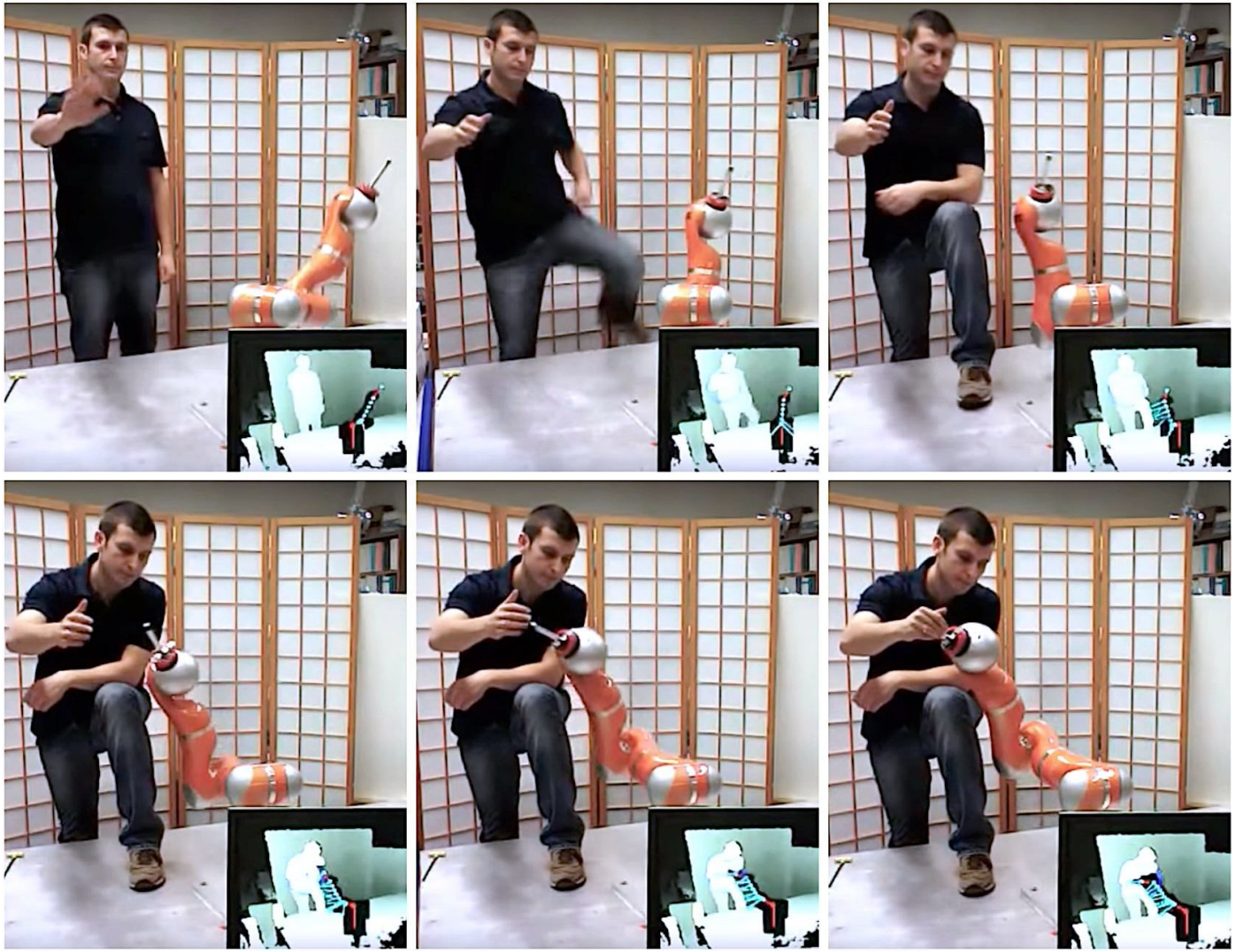
- visual-based motion planning and collision avoidance with the Pisa SoftArm
  - McKibben actuated 3R manipulator
  - stereo vision for mapping depth
  - computation in the configuration space, verification in the Cartesian space

UNIVERSITÀ DI PISA

Centro "E. Piaggio"

Safe pHRI

Research visit at the Stanford AI Lab during his PhD (Jan-June 2011)



The team at SAIL

Stanford Artificial Intelligence Lab (in summer 2011)

Control of robot redundancy

1) Optimal SNS method – 2) Velocity implementation of acceleration-based schemes

IEEE Transactions on Robotics
Jun 2016

https://youtu.be/Zm60jBdP-xs

Robotics and Autonomous Systems
Aug 2015

https://youtu.be/7vdhWkSA-mE

BioRob 2012 Best Paper Award

4th IEEE RAS & EMBS Int. Conf. on Biomedical Robotics and Biomechatronics

The Award was presented by
Maria Chiara Carrozza (Scuola Superiore Sant'Anna),
at that time also Italian Minister of University & Research

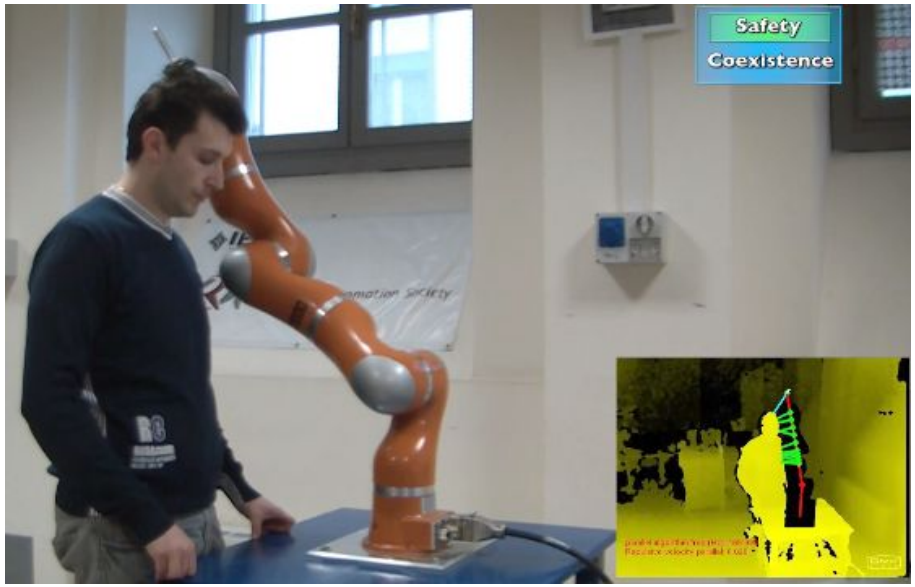
Safe pHRC

Finalist for Best Video Award at IROS 2013, Tokyo

https://youtu.be/pIIhY8E3HFg

SAPHARI project

Demo during the Y3 review meeting in Roma, February 2015



Community service

Fabrizio Flacco

- Co-founder of yearly International Workshop on Human-Friendly Robotics (HFR)
  - organizer of HFR 2013 (https://hfr13.wordpress.com)
- Co-organizer of workshops and tutorials
  - Humanoids 2014 and 2016, ICRA 2015, IROS 2016
  - lecturer at the SAPHARI/NMMI Winter School (Feb 2015)
- Co-chair of RAS TC on Algorithms for Planning and Control of Robot Motion
- Member of the Conference Editorial Board of IROS 2014, ICRA 2015, IROS 2016
- Associate Editor of the *IEEE Robotics and Automation Letters*

Workshop on Human-Friendly Robotics 2013

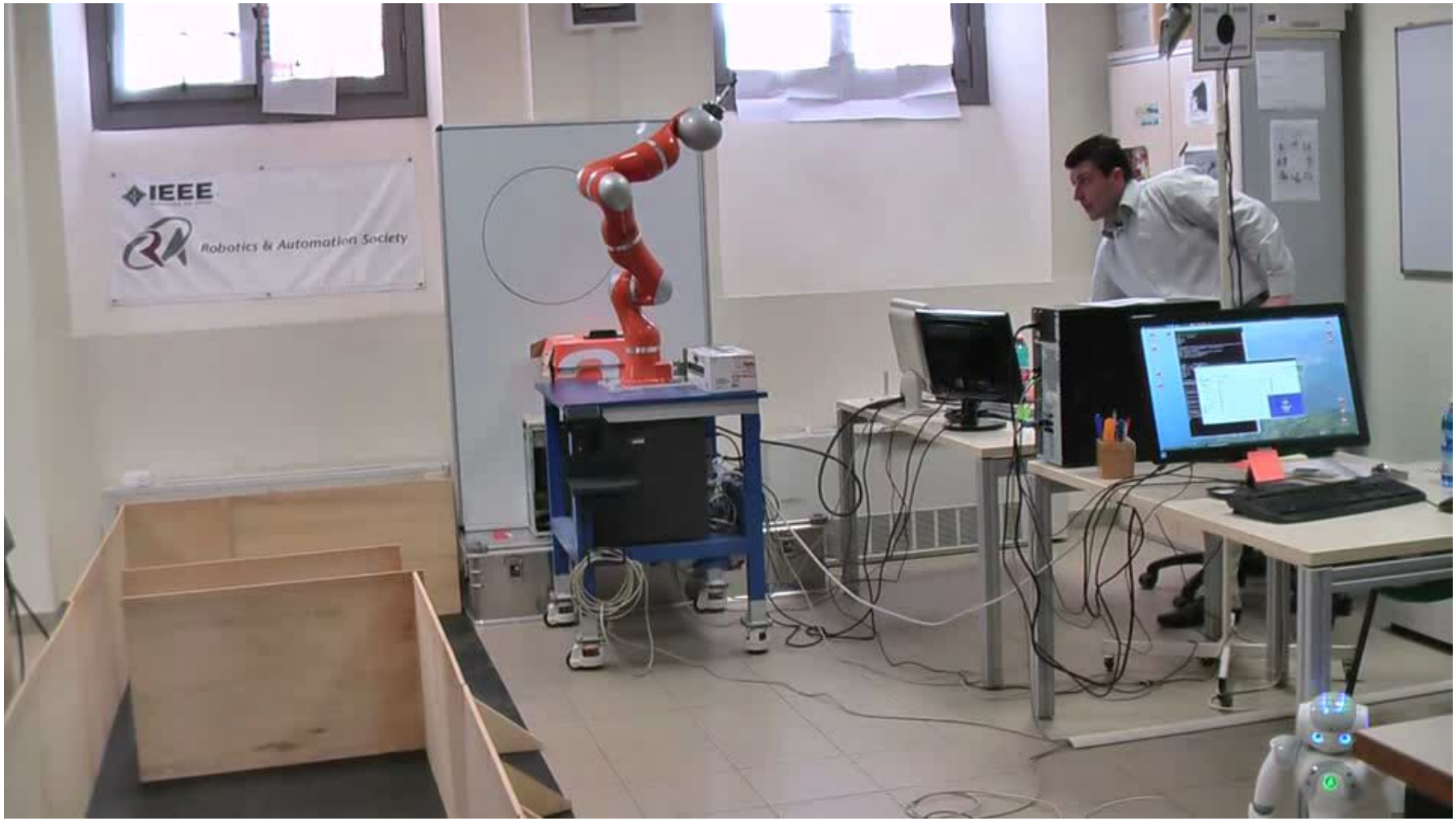
6th edition held @DIAG in Rome, September 2013

Our team at DIAG

Robotics Lab of the Sapienza University of Rome (in 2014)

Fabrizio explaining friendly robots

euRobotics week, OpenDIAG, Sapienza "Porte Aperte": students, visitors, and the general public



Last year

Moving to Montpellier with his wife and two little daughters in Dec 2015

- Interactive Digital Humans (IDH) team @CNRS-LIRRM
- Group of top researchers with complementary expertise
  - HR collaborative assembly tasks
  - humanoids (HRP-2, Romeo2)
  - multi-contact planning and control
- Fabrizio felt immediately at home …

LIRMM

Laboratoire d'Informatique, de Robotique et de Microélectronique de Montpellier

Enjoying our community

Excursions and dinners at conferences around the world

Young Author Best Paper Award 2016

From the IEEE RAS Italian Chapter (@social dinner in Rome, on September 5)

‘Fabrizio Flacco’ Young Author Best Paper Award

Renamed for future editions by I-RAS chapter’s decision

IEEE ITALIAN CHAPTER
IEEE ROBOTICS AND AUTOMATION SOCIETY
I-RAS

Young Author Best Paper Award 2016

Fabrizio Flacco

Alessandro De Luca, Oussama Khatib

Control of Redundant Robots Under Hard Joint Constraints: Saturation in the Null Space,

Transactions on Robotics, IEEE, 31(3), 637 - 654, June 2015

Lucia Pallottino
IEEE I-RAS Chair

Bruno Siciliano
IEEE RAS Past President

Committee: Emanuele Menegatti, Paolo Rocco, Cristian Secchi, Loredana Zollo

- established by the Italian Chapter of the IEEE Robotics & Automation Society in 2009
  - list of previous recipients at http://www.i-ras.it/node/129
- assigned yearly to an I-RAS member less that 35 years old and principal author of the best paper appeared in one of the RAS journals during the previous two years
  - selection by a national committee, award comes with a certificate and a check

Remembering Fabrizio

http://homepages.laas.fr/afranchi/robotics/remembering-fabrizio