Lorenzo Govoni

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Education

2022–Current **Sapienza university of Rome**, *Rome*, Italy
- PhD in Automatic Control, Bioengineering and Operations Research (ABRO)
- Supervisor: Andrea Cristofaro

2020–2022 **Sapienza university of Rome**, *Rome*, Italy
- MSc in Control Engineering, *110/110 cum laude*
- Thesis: "Observer based residuals for fault and collision isolation in robot manipulators"

2021–2022 **Sapienza university of Rome**, *Rome*, Italy
- Student Honours Program: first out of seven winners for the student honours program from the MSc in Control Engineering

2017–2020 **Sapienza university of Rome**, *Rome*, Italy
- BSc in Computer and System Engineering, *110/110 cum laude*
- Thesis: "Synthesis of optimal trajectories in non-holonomic robots with limited field of view"

2012–2017 **Liceo Scientifico Statale Stanislao Cannizzaro**, *Rome*, Italy
- High school degree, *100/100 cum laude*

Master thesis

Title Observer based residuals for fault and collision isolation in robot manipulators

Supervisors Prof. Andrea Cristofaro, PhD Marco Capotondi

Description The goal of this work, implemented at the Robotics Lab in Università di Roma "La Sapienza", is to develop a collision detection framework on a real Kuka LWR 4+ through approximated momentum-based residual based on a reduced-order velocity observer. The main problem is that in simulation the measurements of the joint velocities are given for granted, but when we deal with real robots, speed sensor are not used due to the presence of noise. So in order to improve the estimation of the joint speeds obtained through numerical differentiation, a reduced-order observer has been implemented. Results have been compared also with the case of the use of a full-state observer, and has been stated that the estimation given by the reduced-order observer leads to a residual signal less noisy, which is preferable in the context of collision detection for achieving fast responses in case of collisions

Relevant Projects

Consensus problem in multi-agent hybrid systems, *Control of Multi-Robot Systems project*

Analysis of the behavior of multi-agent systems over networks subject to time-driven jumps. Characterization of the hybrid multi-consensus behaviour when dealing with agents that communicate through distinct communication graphs at jump and flow times. The work has been applied first to simple integrator agents and then extended to the nonlinear case where each robot is modelled as a unicycle. (MATLAB)

Analyzing the Performances of a Compliant 3R Planar Robot using the ESP Control, *Underactuated Robots project*

Analysis of the ESP control approach as a way of assigning a damping behaviour to the link variables of robots with compliant transmissions, in order to overcome oscillatory behaviours when a fast/hard impact occurs on the robot while it is performing regulation/tracking tasks. (MATLAB)

Enforcing mobile robot safety under input constraints, *Autonomous and Mobile Robotics project*

Analysis of the Control Barrier Functions as a way to enforce some safety constraint by ensuring that the inputs will not make the system leave the safe set and will be inside the input constraints. The goal is to generate Input Constrained Control Barrier Functions for solving the Adaptive Cruise Control problem and simulate different scenarios. (MATLAB)

Redundancy in robots with elastic joints: (local) minimization of elastic torques, *Robotics2 project*

Analysis of the local minimization of the weighted elastic torque in a redundant 3R planar robot with elastic joints while following a desired trajectory by comparing different weighting matrices and trajectories. (MATLAB/Simulink)

Optimal Tuning of LQR controller for Quadrotor Helicopters using GA and PSO, *Optimal Control project*

Design of an LQR controller for a quadrotor helicopter with the use of two metaheuristicts, Genetic Algorithm (GA) and Particle Swarm Optimization (PSO), for the optimal tuning of the matrices Q and R. (MATLAB)

Synthesis of optimal trajectories in non-holonomic robots with limited field of view, *Bachelor Thesis*

Analysis of the minimization of distance executed by a non-holonomic robot, i.e. endowed with geometric constraints on the instantaneous motion available, which is equipped with a camera. The robot has to move in the space taking into account either the minimization of space and the physical constraints, while maintaining a fixed point in the space in the limited field of view of the camera. (MATLAB)

Computer skills

Programming languages	Python, Java, C/C++, MATLAB, Simulink, LaTeX
Operating systems	Ubuntu, Windows

Languages

Italian	Mother tongue	
English	Fluent (B2 level)	*written and spoken*

Extra

2017- Tutoring of several high school students in mathematics and physics.