NICOLA SCIANCA
Curriculum Vitae

Part I – General Information

Full Name	Nicola Scianca
Spoken Languages	Italian, English, Japanese

Part II – Education

Type	Year	Institution	Notes (Degree, Experience,…)
University graduation	2010	Sapienza University of Rome	Laurea di Primo Livello in Ingegneria Meccanica
Post-graduate studies	2014	Sapienza University of Rome	Laurea Magistrale in Ingegneria dei Sistemi
PhD	2020	Sapienza University of Rome	Dottorato in Automatica, Bioingegneria e Ricerca Operativa (ABRO), curriculum Automatica

Part III – Appointments

IIIA – Academic Appointments

Start	End	Institution	Position
01/02/2020	31/01/2021	Sapienza University of Rome	Assegno di Ricerca
01/03/2021	28/02/2022	Sapienza University of Rome	Assegno di Ricerca
01/03/2022	28/02/2023	Sapienza University of Rome	Assegno di Ricerca

IIIB – Other Appointments

Start	End	Institution	Position
01/05/2015	30/09/2015	Comtec s.r.l.	Automation Engineer
15/04/2019	10/10/2019	University of California, Berkeley	Visiting Ph.D. Student
28/10/2022	27/11/2022	University of Tokyo	Visiting Researcher

Part IV – Teaching experience

Year	Institution	Lecture/Course
2016/2017	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2017/2018	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2018/2019	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2019/2020	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2020/2021	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2021/2022	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)
2021/2022	Sapienza University of Rome	Applicazioni dell'Automatica (collaboration)
2021/2022	Università Telematica Uninettuno	Teoria dei Sistemi e Controlli Automatici (tutor)
2022/2023	Sapienza University of Rome	Autonomous and Mobile Robotics (collaboration)

Part V - Society memberships, Awards and Honors

Year	Title
2020-2023	IEEE Membership
2020-2023	IEEE Robotics and Automation Society Membership
2020-2023	IEEE Young Professionals

Part VII-A – Research Activities

Keywords	Brief Description
Model predictive control of humanoid robots	Model Predictive Control (MPC) is a popular tool in the control of underactuated robots, especially in the case in which hard constraints must be met in order to satisfy the requirements and the control objectives. In the case of humanoid robots, one of these constraints is given by the requirement that, in order to guarantee balance, the Zero Moment Point (ZMP) must always be maintained inside the convex hull of the contact surfaces. My research in MPC has been mostly devoted to the study of stability and feasibility. An Intrinsically Stable MPC (IS-MPC) [2, 6] has been proposed, which thanks to an explicit stability constraint is capable to guarantee recursive feasibility (which guarantees constraint satisfaction) and internal stability of the scheme. The basic IS-MPC scheme is capable of performing automatic footstep placement, and its properties have been extensively analyzed from a theoretical standpoint, and in simulations and experiments on real platforms. A variant of the basic scheme has been proposed, which uses a modified multimass model [8], for improved ZMP prediction and thus more accurate capabilities of enforcing balance under a variety of circumstances, as well as an extension which is capable of planning simultaneously footstep positions and orientations, thus being able to perform tasks of "walk-to" locomotion [9], instead of the more common tasks which require the robot to follow a given velocity reference. Thanks to a collaboration with the French lab INRIA, the scheme has also been used to perform multi-mode teleoperation of the iCub robot [1].

	A similar scheme has been developed in order to achieve control of Wheeled Inverted Robots [16], a category which shares many traits in common with humanoids due to their balancing nature.
References	[1], [2], [6], [8], [9], [16]

Planning and control of humanoid robots on non-flat ground	Locomotion on uneven grounds require, relative to the simpler case of flat ground, more sophisticated controllers. This is due to the fact that the dynamics of the Center of Mass (CoM) involve nonlinear terms that are difficult to handle. Also, the complexity of the environment requires a more capable footstep planner in order to realize tasks such as reaching a given region in the workspace. Results in this area have been obtained by coupling an evolution of IS-MPC, which includes a 3D model capable of handling CoM height variations [5], with a footstep planner based on Rapidly-exploring Random Trees (RRT) [10] for generating a sequence of footsteps that can lead the robot from the starting position to a desired region. A related line of research employs a different technique for achieving CoM height variations, thanks to the use of the Variable Height Inverted Pendulum model [14], which allowed to not only achieve walk on non-flat ground, but also the generation of running motions.
References	[5], [10], [14]

Robust control of humanoid robots	The objective or robust control is devising strategies in order to allow robots to operate under the effect of disturbances, that might derive either from the effect of external agents such as the environment or other robots, or from the effect of unmodeled internal dynamics. In order to improve the robot capabilities in this sense, several strategies have been proposed. Restriction of the ZMP constraints improves the capabilities of the system to maintain recursive feasibility under the effect of disturbances [15]. The introduction of an observer can aid in the case of constant or slowly varying, because it allows to set up modified constraints that perform indirect compensation [11]. Robustness can also be improved by augmenting the capabilities of the scheme to perform online replanning of the footstep sequence. In particular, modification of the step timings is beneficial when it is necessary to react to impulsive pushes, but it introduces nonlinear constraints. In order to maintain a linear formulation, suitable for real-time, step timings can be adapted in a separate stage with the objective of maintaining the MPC feasibility [4]. A similar strategy can be devised in order to allow for the introduction of nonlinear constraints [17], which can be split into several convex regions and then one is selected based on feasibility considerations.
References	[4], [11], [15], [17]

Safe deployment of humanoid robots	For humanoid robots to be in the same environments as humans, strategies must be devised so to maximize the safety of the interactions that derive from this coexistence. Obstacle avoidance of static obstacles is a well developed field, but avoiding something as unpredictable as the trajectory of a walking human might require online planning of specific evasive maneuvres [3, 7]. Investigation and testing of these maneuvers have led to several works on the subject, eventually culminating in the development of a framework for safe deployment [13].

References	[3], [7], [13]

Learning model predictive control for repetitive systems	Repetitive systems allow for performance improvement by using data collected through the different iterations. During my stay at the University of California, Berkeley, I had the opportunity to work on a Learning MPC scheme [12] which uses collected data to improve the terminal constraint and terminal cost, and thus converge to an optimal performance even with a short prediction horizon.
References	[12]

Part VII-B – Participation in Research Projects

COMANOID H2020, ID: 645097	Multi-contact Collaborative Humanoids in Aircraft Manufacturing

Part VIII – Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Papers [international]	17	Scopus	2016	2022

Total Impact factor	19,640
Total Citations	151
Average Citations per Product	8,88
Hirsch (H) index	7
Normalized H index*	1

*H index divided by the academic seniority.

Part IX– Selected Publications

List of the publications selected for the evaluation. Citation number is from SCOPUS. Impact factor, when present, is from Web of Science.

	International Journals	Cit	IF
1	L. Penco, N. Scianca, V. Modugno, L. Lanari, G. Oriolo, S. Ivaldi, A Multimode Teleoperation Framework for Humanoid Loco-Manipulation: An Application for the iCub Robot, IEEE Robotics & Automation Magazine, 2019, DOI: 10.1109/MRA.2019.2941245	12	5.229
2	N. Scianca, D. De Simone, L. Lanari, G. Oriolo, MPC for Humanoid Gait Generation: Stability and Feasibility, IEEE Transactions on Robotics, 2020, DOI: 10.1109/TRO.2019.2958483	30	6.835
3	N. Scianca, P. Ferrari, D. De Simone, L. Lanari, G. Oriolo, A behavior-based framework for safe deployment of humanoid robots, Autonomous Robots, 2021, DOI: https://doi.org/10.1007/s10514-021-09978-5	1	3.255
4	F. M. Smaldone, N. Scianca, L. Lanari, G. Oriolo, Feasibility-Driven Step Timing Adaptation for Robust MPC-Based Gait Generation in Humanoids, IEEE Robotics and Automation Letters, 2021, DOI: 10.1109/LRA.2021.3059627	3	4.321
5	F. M. Smaldone, N. Scianca, L. Lanari, G. Oriolo, From Walking to Running: 3D Humanoid Gait Generation via MPC, Frontiers and Robotics and AI, 2022, DOI: 10.3389/frobt.2022.876613	0	-

	International Conferences	Cit	
6	N. Scianca, M. Cognetti, D. De Simone, L. Lanari, G. Oriolo, Intrinsically Stable MPC for Humanoid Gait Generation, IEEE-RAS 16th International Conference on Humanoid Robots, 2016, Cancun, Mexico, DOI: 10.1109/HUMANOIDS.2016.7803336	35	
7	D. De Simone, N. Scianca, P. Ferrari, L. Lanari, G. Oriolo, MPC-based humanoid pursuit-evasion in the presence of obstacles, IEEE International Conference on Intelligent Robots and Systems, 2017, Vancouver, Canada, DOI: 10.1109/IROS.2017.8206415	9	
8	N. Scianca, V. Modugno, L. Lanari, G. Oriolo, Gait generation via intrinsically stable MPC for a multi-mass humanoid model, IEEE-RAS International Conference on Humanoid Robots, 2017, DOI: 10.1109/HUMANOIDS.2017.8246926	2	
9	A. Aboudonia, N. Scianca, D. De Simone, L. Lanari, G. Oriolo, Humanoid gait generation for walk-to locomotion using single-stage MPC, IEEE-RAS International Conference on Humanoid Robots, 2017, Birmingham, United Kingdom, DOI: 10.1109/HUMANOIDS.2017.8239554	8	
10	A. Zamparelli, N. Scianca, L. Lanari, G. Oriolo, Humanoid Gait Generation on Uneven Ground using Intrinsically Stable MPC, Symposium on Robot Control, 2018, Budapest, Hungary, DOI: https://doi.org/10.1016/j.ifacol.2018.11.574	21	
11	F. M. Smaldone, N. Scianca, V. Modugno, L. Lanari, G. Oriolo, Gait Generation using Intrinsically Stable MPC in the Presence of Persistent Disturbances, IEEE-RAS 19th International Conference on Humanoid Robots. 2019. Toronto, Canada, DOI: 10.1109/Humanoids43949.2019.9035068	9	
12	N. Scianca, U. Rosolia, F. Borrelli, Learning Model Predictive Control for Periodic Repetitive Tasks, European Control Conference, 2020, Saint Petersburg, Russia, DOI: 10.23919/ECC51009.2020.9143857	4	

Part X– Other Publications

List of publications not selected for evaluation. Citation number is from SCOPUS.

	International Conferences	Cit	
13	M. Cognetti, D. De Simone, F. Patota, N. Scianca, L. Lanari, G. Oriolo, Real-time pursuit-evasion with humanoid robots, IEEE International Conference on Robotics and Automation, 2017, Singapore, Singapore, DOI: 10.1109/ICRA.2017.7989470	6	
14	P. Ferrari, N. Scianca, L. Lanari, G. Oriolo, An Integrated Motion Planner/Controller for Humanoid Robots on Uneven Ground, 18th European Control Conference, 2019, Napoli, Italy, DOI: 10.23919/ECC.2019.8796196	4	
15	F. M. Smaldone, N. Scianca, V. Modugno, L. Lanari, G. Oriolo, ZMP Constraint Restriction for Robust Gait Generation in Humanoids, IEEE International Conference on Robotics and Automation, 2020, Paris, France, DOI: 10.1109/ICRA40945.2020.9197171	7	
16	M. Kanneworff, T. Belvedere, N. Scianca, F. M. Smaldone, L. Lanari, G. Oriolo, Task-Oriented Generation of Stable Motions for Wheeled Inverted Pendulum Robots, IEEE International Conference on Robotics and Automation, 2022, Philadelphia, USA, DOI: 10.1109/ICRA46639.2022.9812317	0	
17	A. S. Habib, F. M. Smaldone, N. Scianca, L. Lanari, G. Oriolo, Handling Non-Convex Constraints in MPC-Based Humanoid Gait Generation, IEEE/RSJ International Conference on Intelligent Robots and Systems, 2022, Kyoto, Japan, DOI: 10.1109/IROS47612.2022.9981419	0	

Roma, 03/02/2023