# Manuel Santos Silva

25-11-2026

## 1. Scientific and professional profile and career

Manuel F. Silva graduated from the Faculty of Engineering of the University of Porto (FEUP), Portugal, in 1993. He started his professional career as a research fellow at CCP – CIM Centre of Porto and in 1997 he was hired by this same institution, where he stayed until February 1999. While at CCP he mainly worked in the simulation and programming of industrial robots and was responsible for CCP's training area. During this same period, he enrolled in the Master Course in Electrical and Computer Engineering at FEUP and received his MSc. with a thesis on simulation and offline programming of assembly robots. In March 1999 he took a position as Teaching Assistant at the Department of Electrical Engineering (DEE) of the Institute of Engineering of the Porto Polytechnic (ISEP). From September 2001 he carried out the work leading to his doctoral thesis at FEUP, on Multi-Legged Locomotion Robotic Systems, which he defended in July 2005. During this period, he often attended the CLAWAR conference. From September 2005 he started lecturing several courses on the Master on Electrical and Computer Engineering (EEC) at ISEP and, between this period and the end of 2011, focused on courses preparation and the supervision of students from the capstone course on the Degree on EEC and Master Thesis on the Master on EEC, both at ISEP. Meanwhile, in May 2010 he became Adjunct Professor at ISEP's DEE. In January 2012 he joined INESC TEC Centre for Robotics as a Senior Researcher and he started collaborating on R&D projects conducted at this Centre. In May 2014 he co-organized the Portuguese Robotics Open (Festival Nacional de Robótica), an event from the Portuguese Robotics Society, and in 2017 he was the General Chair of the CLAWAR 2017 Conference, an event from the CLAWAR Association Ltd., which was held at ISEP. In December 2020 he became Associate Professor at ISEP's DEE and in July 2024 Co-Coordinator of INESC TEC's Centre for Robotics in Industry and Intelligent Systems.

## 2. Contributions to science and society

### 2.a. Contributions to the generation of new ideas, tools, methodologies or knowledge

Throughout my professional career I have been involved in several R&D projects, mainly in robotics and industrial applications of robotics, and lately I have taken responsibility for some of these. I have authored or co-authored more than 250 papers in international journals and conferences with peer revision, have edited 24 books and six special issues of international journals and have been involved in the organization of several national and international conferences, in some as General Chair. Moreover, I am a trustee of the CLAWAR Association Ltd., registered in 2012 with the Charities Commission in the UK as a charitable organisation with the mission to advance robotics for the public benefit. In addition, I was president of the Portuguese Robotics Society, as well as its treasurer, secretary, and member of the executive committee.

In more detail, I was a pioneer in studying the fractional order control of multi legged locomotion robots (DOI: 10.1007/s11071-004-3770-8; DOI: 10.1177/1077546306070608; DOI: 10.1177/1077546307087436) and on

mathematical modelling these robots with articulated segments in its body (DOI: 10.1017/S0263574704001195).

I was also a strong advocate for the use of simulation and offline programming of industrial robots, and this interest has paved the way for the development of some academic works (DOI: 10.1109/ICARSC.2016.56; DOI: 10.1109/ICARSC.2018.8374159) that latter resulted in the development of a research project focused on this topic (https://www.inesctec.pt/en/projects/adaptpack) and in transferring this knowledge to industrial companies (DOI: 10.1007/978-3-319-70836-2_56 ; DOI: 10.1108/IR-12-2019-0252; DOI: 10.1108/IR-12-2019-0253). This interest also gave rise to a course on robotics, taught in the scope of the Master Course on Electrical and Computer Engineering at ISEP (DOI: 10.1109/CISPEE.2013.6701992; DOI: 10.1145/2808580.2808611). Due to its characteristics, this course has raised some interest at some of ISEP's international partner institutions and has been presented as part of several ERASMUS mobility programmes I have participated in.

Later, I was involved in the study, modeling and development of a few biological inspired robots (DOI: 10.1145/2808580.2808614), namely inspired in the spider crab (DOI: 10.12989/bme.2015.2.4.249), fishes (DOI: 10.12989/arr.2014.1.3.239; DOI: 10.1145/2808580.2808613; DOI: 10.1007/978-3-319-50337-0_21), and birds (DOI: 10.1145/2808580.2808612; DOI: 10.1007/978-3-319-27146-0_18). All these studies have been applied in academic works involving students from distinct backgrounds and academic levels.

Presently I am involved in the development of robotic solutions to ease intralogistics tasks, combining mobile robots with manipulation. In this scope, I am the responsible at INESC TEC's CRIIS for the GreenAuto and Produtech R3 Agendas, included in the Resilience and Recovery Mechanism, in which we are developing mobile robotics solutions for the autonomous handling of component transport boxes for the automotive industry and for the handling of pallets of paper boxes with teleoperation capabilities over the 5G public communications network for error recovery (DOI: 10.1007/978-3-031-58676-7_40; DOI: 10.1109/ROBOT61475.2024.10797434; DOI: 10.1109/ROBOT61475.2024.10797410; DOI: 10.1109/ICARSC65809.2025.10970150; ). We are also developing automatic container unloading solutions for distribution companies.

Finaly, I am also involved in launching and promoting a new area of research at CRIIS, namely in the applications of robotics to health. In this context, we have been working on the development of autonomous wheelchairs (DOI: 10.1007/s42452-021-04304-1) and the development of robotic solutions to support the recovery of stroke patients, either through the detection of compensatory movements (DOI: 10.1088/2516-1091/adeb1e) or through the automation of physical rehabilitation exercises, using robotics (DOI: 10.3390/robotics14100141; DOI: ) and serious games (DOI: 10.3390/app15158240).

### 2.b. Contributions to the training and career development of researchers and/or research teams

In the scope of my teaching activities, I have supervised more than 100 Master Students and have always tried to identify the ones with a more scientific profile and invited these to pursue their studies, at a PhD level, namely at INESC TEC's CRIIS. In this context, eight PhD. students that were previously my MSc students have already pursued their PhD. studies at CRIIS.

Furthermore, and recognising the potential of robotics competitions to encourage the emergence and development of skills for independently researching innovative solutions to common problems, I created and have promoted two robotics competitions as part of the Portuguese Robotics Open (Festival Nacional de Robótica), namely the Robot Dragster and Industrial Robotic Manipulators competitions. The Robot Dragster competition is presently the robotics competition with the highest number of participants in the Portuguese Robotics Open. Besides, I have been actively involved in the organization of this event, and these two competitions, for the last years.

In this context, I was also the promoter of the Robotics@ISEP Open, an event which aims to raise awareness among students about robotics by involving them in the use of techniques and tools in this field. This event is based on two main points of interest, namely robotics competitions, and robotics training for students who want support to participate in competitions.

Presently, and as Co-Coordinator of INESC TEC's Centre on Robotics in Industry and Intelligent Systems (CRIIS), I manage a strong team of around 100 researchers internationally recognised for their expertise in diverse fields of robotics, namely manipulation, mobile robotics, mobile manipulation, and agricultural and medical applications of robotics, and have supported the development of all team members, through fostering scientific excellence via Q1 publications and transfer of knowledge to the industry.

### 2.c. Contributions to the scientific community

Throughout my professional career, I have always contributed to the scientific community in various ways. Besides participating in more than 230 program and scientific committees of various conferences and other scientific events and performing peer review of papers for these events, as well as peer review of papers for several reputed international journals, I have focused on the organization of several international conferences and edited above 20 books and 9 Special Issues of international journals. In this scope, I have to mention the work performed in the topic of climbing and walking robots. During my PhD. I have presented several papers at the CLAWAR – Climbing and Walking Robots and the Support Technologies for Mobile Machines Conferences. During this period, I nurtured several work relations with distinct colleagues from this community and, in 2017, together with several colleagues, we organized the 20th International CLAWAR Conference at Porto, of which I was General Co-Chair. From that edition onwards, I have been actively collaborating with the CLAWAR Association Ltd., collaborating on the organization of all CLAWAR and ICRES conferences from that year onwards. Due to these contributions, I am a CLAWAR Association Ltd. Trustee since 2023. More recently I was General Co-Chair of the ICRES 2025 Conference, which took place at ISEP. Moreover, I have also encouraged these conferences to be held in Portugal and in countries where Portuguese is the official language.

### 2.d. Contributions to society

Throughout my career, I have also contributed to society in various ways, mainly by seeking to pass on much of the knowledge generated to national companies and also by seeking to disseminate my knowledge of robotics to young people and attract them to this scientific field.

Regarding the technology transfer to industrial companies, I have always been a strong advocate of offline programming of industrial robots using 3D simulation tools and have influenced several companies to adopt this methodology, either directly or through students' supervision during the completion of their Master's thesis in industrial environments, in the practical application of these methodologies. Finally, several R&D projects in which I am involved, as well as applications I have coordinated, are in areas of technology transfer to national companies.

In relation to the dissemination of knowledge to youngsters, I have done this in three main ways: by promoting and organizing robotics competitions, by mentoring teams of young people to participate in these events, and by giving demonstrations and lectures on science and robotics to students at different levels of education, from kindergartens to primary schools and secondary schools. I was co-organizer of the Portuguese Robotics Open (Festival Nacional de Robótica) in 2014 and 2016 and was a member of the organizing Committee of this event in 2019 – 2025. I have also mentored junior teams participating in this event and in the European RoboCup Junior.

## 3. Scientific production and/or selected activities

Given the areas on which INESC TEC's CRIIS, and myself, are focusing our R&D work, these are the five works which I consider most relevant to my research, as well as the reasons for this choice.

[SP.1] L. Oliveira, A. Moreira, **M. F. Silva**; *Advances in Agriculture Robotics: A State-of-the-Art Review and Challenges Ahead*; Robotics; 10(2); 2021. DOI: 10.3390/robotics10020052.

State-of-the-Art Review on agricultural robotics, a topic researched at INESC TEC, while also presenting some of the challenges ahead for this area, allowing to better understand the directions that should be followed on this topic.

[SP.2] R. B. Sousa, C. Rocha, H. S. Mendonça, A. P., **Manuel Silva**; *Gerber File Parsing for Conversion to Bitmap Image – The VINCI7D Case Study*; IEEE ACCESS; 10; 2022. DOI: 10.1109/ACCESS.2022.3187042.

Presents the development of a solution allowing the transfer of a Gerber file, commonly used for PCBs, to a bitmap image. This is the first step of a process allowing robotic 3D printing of electrical circuits on 3D plastic parts for the automotive industry, which renders these parts to become functional elements of an automobile. This concept was later extended to other parts, namely shoes.

[SP.3] C. D. Rocha, I. Carneiro, M. Torres, H. P. Oliveira, E. J. S. Pires, **M. F. Silva**; *Post-stroke upper limb rehabilitation: clinical practices, compensatory movements, assessment, and trends*; Progress in Biomedical Engineering; 7(4); 2025. DOI: 10.1088/2516-1091/adeb1e.

Review paper on a topic that we are starting to explore at INESC TEC's CRIIS, related to the application of robotics and computer vision to the clinical rehabilitation of stroke patients.

[SP.4] P. A. Dias, J. P. C. Souza, E. J. S. Pires, V. Filipe, D. Figueiredo, L. F. Rocha, **M. F. Silva**; *Robot Path Planning: from Analytical to Computer Intelligence Approaches*; Journal of Intelligent & Robotic Systems: 111(112) 2025. DOI: 10.1007/s10846-025-02322-4.

Updates the techniques used in path planning, a topic widely used and explored at INESC TEC's CRIIS.

[SP.5] D. G. Gonzalez, R. C. Nascimento, C. D. Rocha, **M. F. Silva**, V. Filipe, L. F. Rocha, L. G. Gonzalez, A. Cunha; *Active Learning for Industrial Defect Detection: A Study on Hybrid Sampling Strategies*; The International Journal of Advanced Manufacturing Technology; 2026.

Describes the use of active learning techniques to generate annotated images of parts to be used for automatic inspection of defects, increasing the speed of generating datasets for this purpose.