

SPECIAL SESSION ON

Classical Controllers Versus Artificial Intelligence Toward Smart Robots Control Strategies

Session Co-Chairs:

- Chiraz Ben Jabeur, Assistant Professor, University of Computer Science ISI, chirazbenjabeur@gmail.com
- Nahla Khraief Haddad, Associate professor, University of Tunis, khraiefnahla@gmail.com.

Session description:

Over the years, many methods for control have been developed. Each of these has had its own advantages and disadvantages over other methods. The different methods of control can be divided into two categories: Classical Control and Intelligent Control. The differences between these two categories are based on the benefits of each of these categories. For any mobile robot, the ability to navigate in its environment is important. Navigation is a field of research that focuses on the process of determination/estimation of a robot's position and velocity, as well as its attitude. It is also often associated with feedback control, which is dealing with the design of systems to control the movement of robot. Control refers to the manipulation of actuators, to execute guidance commands and maintain stability of the vehicle. Recent advancements are achieved in this field and concern the determination and (or) control of the states of the vehicle (position, direction, attitude, altitude, velocity, etc.). Avoiding dangerous situations such as collisions and unsafe conditions (temperature, radiation, exposure to weather, etc.) in a smart way, is very important to accomplish the mission of robot.

This special session deals with classical controllers versus artificial intelligence toward smart robots control strategies; it consists of a smart tracking control and navigation of mobile robots with the use of classical controllers such as PD, PID and others and artificial intelligence based on neural networks, fuzzy logic and genetic algorithms. In fact, when tracking a trajectory, the robot may encounter some obstacles. These obstacles (depending on the robot environment) can damage the robot or blocks its navigation or change its trajectory. Recently the use of artificial intelligence in robotics is become one of the exciting tools to avoid them. The goal is to implement artificial intelligence controllers for optimal navigation allowing optimisation in terms of time and errors. It is also to impose trajectories that mobile robot must be able to follow. We invite original papers that address new developments in the research on artificial intelligence based indoor/outdoor navigation and control strategies. The main goal is to summarize the theoretical and experimental results within this field and present different applications.

The principal topics planned to be covered are as follows, but are not limited to:

- Artificial intelligence control in robotics;
- Path planning and self-localization;
- Speed, tracking and obstacle avoidance control ;
- Trajectory optimization in navigation;
- Machine learning for robot state estimation and control;

- Applications on aerial, marine and terrestrial robot navigation and control systems;
- Robot path planning in the presence of static or dynamic obstacles;
- Multi-robot system application with artificial intelligence;
- Intelligent control techniques for path planning of humanoid robots.



Dr. Chiraz Ben Jabeur

Chiraz BEN JABEUR holds an engineer degree since 1996 from the national school of engineer of Sfax in electrical engineering. She also obtained a Master Degree (2002) and a PhD Degree in Electrical Engineering (2007). Now she is Associate Professor at the higher institute of informatics (ISI) in the Department of Electrical Engineering and Computer Science. She is a member of the research laboratory: (RIFTSI) at the University of Tunis. She supervises many theses in the field of smart robots control such as (rolling or flying or floating robots). All her research focus on systems Control and artificial intelligence such as neural networks, fuzzy logic, genetic algorithms and deep-learning related to mobile robots domain. She has many publications in international impacted journal and ranked conferences. She proposed many special sessions in conferences and organized workshops. She served as reviewer for many impacted international journals.



Dr. Nahla Khraief Haddad

In October 2021 Dr Nahla Khraief received her HDR from Université Polytechnique Hauts-de-France. She also received her university habilitation in electrical engineering from the University Of Carthage, Tunisia, in 2018. She obtained her Ph.D. degree in ROBOTICS from UVSQ (Université de Versailles Saint Quentin en Yvelines), France, in 2004. In 1999 she received her Msc in automatic control from ENSIT (Ecole Nationale Supérieure des ingénieurs de Tunis). Her Bsc in electrical engineering was obtained in 1995 from ENIS (Ecole nationale d'ingénieurs de Sfax). During 2002/2003/2004 she has been a Research and Teaching assistant at LRV (Laboratoire de Robotique de Versailles now it is called LISV) and University of Cergy, France. She is currently a research scientist at RISC-Lab (Laboratory of Robotics, Computer Science and complex systems) at ENIT (Ecole Nationale d'ingénieurs de Tunis). She is also a tenured associate professor at ENICAR (Ecole Nationale d'Ingénieurs de Carthage).

Her research interests include nonlinear analysis based on chaos and bifurcation theory. Her investigation deals also with nonlinear (adaptive, sliding, predictive,...) control and their real-time applications in

different fields of robotics (underactuated robotic systems, quadcopter, Humanoid robotics and wearable robotics). She is the author of more than 50 scientific publications including international journals, patents, book chapters and international conferences. She co-supervised 7 PhD theses (including 2 defended) and more than 15 MSc theses. She served as a TPC/IPC member or associate editor for different international conferences. In 2014 she was in a postdoctoral position at the Montpellier Laboratory of Computer Science, Robotics and Microelectronics (LIRMM) with Dr AHMED CHEMORI.

She has been a visiting researcher/professor at different institutions (ENSEA, Cergy France, KAUST - Saudi Arabia, Université Française de l'Egypte, etc). She has also delivered various plenary/keynote lectures at different international conferences.