

Control of intelligent autonomous systems: mobile robots, vehicles and UAVs

Proposal of Open invited track for the 20th IFAC World Congress

Track organizers:

Prof. Hideki HASHIMOTO, Chuo University, JAPAN , hashimoto@elect.chuo-u.ac.jp TC 4.3

Prof. Peter KORONDI, Budapest Univ. of Tech. and Econom., HUNGARY, korondi@mogi.bme.hu TC 4.3

Prof. Mark J. BALAS, Embry-Riddle Aeronautical University, USA, balasm@erau.edu TC 7.3

Prof. Radhakant PADHI, Indian Institute of Science, INDIA padhi@aero.iisc.ernet.in TC 7.3

Prof. Zdzisław KOWALCZUK, Gdansk University of Technology, POLAND, kova@pg.gda.pl, TC 7.5

Prof. Ljubo VLACIC, Griffith University, Brisbane, AUSTRALIA, l.vlacic@griffith.edu.au TC 7.5

Abstract:

Moving devices (mobile robots, vehicles and UAVs) which can operate in non-industrial (nonstandard) environment need to have totally new functions and behaviours. It is not enough to execute a pre-programmed action line. They must be able to adapt to changing environments, make their own decisions and in addition, they might have to socially fit into the human environment. They have to follow regulations developed originally for human beings. It means that new problems of control are emerging and have to be solved. This Open invited track provides an opportunity to present and discuss research and development work in the hot area of intelligent autonomous systems. Researchers and practitioners in the field of land, air and marine robotics are brought together to discuss common problems of theoretical and practical applications, describe scientific and commercial applications and explore the possibilities for future research.

IFAC technical committee(s): TC 4.3, TC 7.3 and TC 7.5

Detailed description:

This Open Invited track focuses on the problems related to the control of different moving systems like road and off-road vehicles, UAVs, indoor and outdoor robots including Moon and Mars rovers. The common and most important keywords of this track are “intelligent” and “autonomous”.

Devices which can move and operate in environment unapproachable or dangerous for human beings need a kind of autonomous operation. The design problems are not only in their physical construction, but also in their algorithms of behaviour. The necessary adaptation features can be based on various AI ideas inspired by the nature. An especially interesting approach consists in utilizing models of psychology and cognition of living creatures (including motivations, needs, emotions, mood, etc.), as well as various methods of decision making, to cope with the issue of adaptation to the environment and/or communicating with it.

There are other challenges if the device moves among human beings in a social environment. For example in households and offices, in medical areas caring for the elderly or autistic children or in rehabilitation. If we want to have coexistence and cooperation on a daily basis with robots, we have to first think about robots not as simple human replacements, but as co-workers, which aid their partners. To achieve this, we may have to rethink Asimov’s robot law statements, how it could be implemented in a non-industrial environment, where even humans injure themselves unwantedly.

The automotive industry is focusing on active safety technologies, which may ultimately lead to partially autonomous driving, where humans will become passengers of automated vehicles governed by automatic

control algorithms for substantial parts of their trips, leading to improved safety, better fuel economy, and better utilization of the available infrastructure.

Technical Outline of the Session and Topics:

Topics of interest include, but are not limited to:

- Semi-, highly- and fully-automated driving
- Control of Interconnected Vehicles and Fleets
- Moon and Mars rovers
- Etho-Robotics, ethologically inspired robot motion and behaviour
- Cognitive robot programming and supervising autonomous agents
- The use of cognitive approaches in designing intelligent robots, intelligent vehicles and UAVs including HSI /HMI aspects.
- Cognitive robotics - modelling of cognitive processes for robotics applications.
- Collective robotics – research field, where many robots work as one group to achieve a common goal.
- Intelligent systems, agents and robots - design and implementation of artificial intelligence-based systems aimed at managing or controlling autonomous robots, agents, UAVs and/or intelligent vehicles.
- Machine intelligence – intelligent systems based on computational methods and used in stand-alone applications of robotic systems, intelligent road vehicles, aerial and underwater vehicles.

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