Event title: Motion Control of Biomimetic Autonomous Underwater Vehicles

Organising OU: IEEE IES WA Chapter

Date and time of the event: Friday, 27 June 2025, 5:00 - 6:30 pm (AWST)

Speaker(s): Dr Ahmed CHEMORI, Laboratory of Computer Science, Robotics and Microelectronics (LIRMM), University of Montpellier, CNRS, France

For registration do this: https://www.eventbrite.com.au/e/1418096949149?aff=oddtdtcreator

Registration fee, if any: NO

Who can attend (IEEE members and non-members?): Both IEEE members and non-members

Online meeting: https://teams.microsoft.com/l/meetup-join/19%3ameeting_YjM3MTAzZjgtNWZiYi00YTVlLWIxN2UtN2JhOTY5ZDZlZGU3%40thread.v2/0?context=%7b%22Tid%22%3a%22c00d4c1b-cf7b-4e93-b7c7-10113a9bc230%22%2c%22Oid%22%3a%227a7dc7fe-afe9-4a76-852e-002ec419ae6d%22%7d

Abstract:

Biomimetic Autonomous underwater vehicles propose alternatives for conventional propeller-driven underwater vehicles. Median and paired fin (MPF) locomotion is usually suggested as a viable alternative when high maneuverability and hovering capability is required. In fishes, such a propulsion mechanism usually means lower speeds (as opposed to body and caudal fin propulsion) but is advantageous when low speed and precision maneuverability is desired. A particular type of MPF propulsion is sea turtle like 4-fin locomotion. Attempts to copy the locomotion of those agile and versatile reptiles reach back at least a decade with Turtle 2005 and Madeline. Other examples include Finnegan, the RobotTurtle and iRobot Transiphibian. Another line of development is represented by AQUA and AQUA2 four finned amphibian robots that are unique in the way the propellers are used both for swimming and crawling in and out of water. Four-finned propulsion was also realized in some prototypes by deploying a scaffold structure actively controlled by shape memory alloy (SME) wires. U-CAT is an autonomous biomimetic underwater robot developed within ARROWS (Archeological Robot Systems for the World Seas) European project. As opposed to the previous examples, four-finned design of this vehicle is motivated solely by the end-user requirements and environmental constraints of the tasks in this specifically shipwreck inspection. It should closely video-inspect underwater objects. When interested in control of biomimetic autonomous underwater vehicles, various challenges are to be considered (highly nonlinear dynamics, time-varying parameters, strong coupling between coordinates, underactuation, etc.). This talk deals with motion control of Biomimetic autonomous underwater vehicles, with a special focus on the case study of U-CAT turtle-like biomimetic underwater robot. The proposed control solutions (including priority-based, acoustic-based, vision-based, and data-fusion-based) will be illustrated through different scenarios of real-time experiments in a swimming pool (controlled environment), as well as in open water (real operating conditions).

***Presenter's Bio*:**

Ahmed Chemori received his M.Sc. and Ph.D. degrees, both in automatic control, from the Polytechnic Institute of Grenoble, France, in 2001 and 2005 respectively. During the year 2004/2005 he was a Research and Teaching assistant at Laboratoire de Signaux et Systèmes (LSS - Centrale Supelec) and the University Paris 11. Then he joined Gipsa-Lab (Former LAG) as a CNRS postdoctoral researcher. He is currently a senior CNRS researcher in Automatic Control and Robotics for the French National Center for Scientific Research (CNRS), at the Montpellier Laboratory of Computer Science, Robotics and Microelectronics (LIRMM). His research interests include nonlinear (adaptive, robust, and predictive) control and their real-time applications in different fields of robotics (Underwater robotics, underactuated robotics, parallel robotics, humanoid robotics, and wearable robotics). He is the author of more than 185 scientific publications, including international journals, patents, books, book chapters, and international conferences. He co-supervised 26 PhD theses (including 21 defended) and more than 35 MSc theses.

He is currently an IEEE Senior Member and Technical Editor of the Journal "IEEE/ASME Transactions on Mechatronics", associate editor for the journal "Frontiers in Robotics and AI", and guest editor for several special issues. He is a member of the IFAC Technical Committee on Adaptive and Learning Systems (TC 1.2), the IFAC Technical Committee on Mechatronic Systems (TC 4.2), the IFAC Technical Committee on Robotics (TC 4.3), and the IFAC Technical Committee on Marine Systems (TC 7.2). He served as a TPC/IPC member or associate editor for several international conferences, and he organized different scientific events.

For further information contact: A/Prof Hai Wang (hai.wang@murdoch.edu.au)

Western Australia Section : http://ewh.ieee.org/r10/w_australia/