THE CHINESE UNIVERSITY OF HONG KONG
Department of Electronic Engineering
Seminar

Robust and Intelligent Formation Control of Autonomous Underwater Vehicle Fleets

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Abstract

Formation control of autonomous underwater vehicle (AUV) fleets has an increasingly wide range of applications and has attracted much attention in the past few years. Due to its interdisciplinary nature, synthesis of high-performance AUV formation systems is still faced with numerous challenges and obstacles, both theoretically and practically. This talk will focus on several robust and intelligent formation control methods for a fleet of multiple AUVs. Firstly, a novel distributed bio-inspired sliding mode formation protocol is developed to address the robust consensus formation tracking problem. This formation protocol considers the synchronization errors between neighboring AUVs and accounts for the impacts of ocean waves, currents, and uncertain hydrodynamic effects. Secondly, a robust learning-based approach is introduced to handle scenarios where nominal models of AUVs are unavailable for formation control design. A rigorous analysis is provided to ensure the feasibility of the method. After that, an innovative on-line motion optimization procedure is developed to tackle robust constrained consensus formation tracking. More precisely, this designed motion optimizer allows to generate coordination commands that not only satisfy the constraints enforced (e.g., velocities) but also dynamically optimize coordination performance. Finally, a stability criterion is developed responsible for the impact of non-uniform communication delays in coordination, and in addition, a new online optimal control approach is proposed to resolve robust control with motion constraints.

Biography

Prof. Simon X. Yang received the B.Sc. degree in engineering physics from Beijing University, China in 1987, the first of two M.Sc. degrees in biophysics from Chinese Academy of Sciences, Beijing, China in 1990, the second M.Sc. degree in electrical engineering from the University of Houston, USA in 1996, and the Ph.D. degree in electrical and computer engineering from the University of Alberta, Edmonton, Canada in 1999. Prof. Yang joined the School of Engineering at the University of Guelph, Canada in 1999. Currently he is a Professor and the Head of the Advanced Robotics & Intelligent Systems (ARIS) Laboratory at the University of Guelph in Canada. Prof. Yang has diversified research expertise. His research interests include intelligent systems, robotics, control systems, sensors and multi-sensor fusion, wireless sensor networks, intelligent communications, intelligent transportation, machine learning, and computational neuroscience. He has published over 550 academic papers, including over 350 journal papers. Prof. Yang he has been very active in professional activities. Prof. Yang has served as the Editor-in-Chief of Intelligence & Robotics, and some other journals; and an Associate Editor of IEEE Transactions on Cybernetics, IEEE Transactions on Artificial Intelligence, and several other journals. He has involved in the organization of many international conferences.

***** ALL ARE WELCOME *****

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