Special Issue

Learning and Control of Underactuated Mechanical System

Message from the Guest Editors

Dear colleagues, In the last few decades, there has been great theoretical and practical interest in learning and controlling underactuated mechanical systems. These systems are defined as underactuated because they have more joints than control actuators. Much of this interest is a consequence of the importance of such systems in applications. Furthermore, when one or more joints of a standard manipulator fail, it becomes an underactuated mechanism and needs a special control algorithm to continue operation; thus, the development of learning and control techniques for underactuated systems will increase the reliability and fault tolerance of current and future robots. Interest in studying underactuated mechanical systems is also motivated by their role as a class of strongly nonlinear systems where complex internal dynamics, nonholonomic behavior, and lack of feedback linearizability are often exhibited. Traditional nonlinear control methods are insufficient in these cases, and new approaches must be developed. This Special Issue aims to present advances in both learning and control of underactuated mechanical systems and the use of underactuated systems in application domains.

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Message from the Editorial Board

We are just entering the Next Wave of Technology (NWT) where actuators will play the same role as the computer chip did for computers/social media approximately four decades ago. Just in the U.S., production of $1 trillion year of electromechanical systems (vehicles, orthotics, manufacturing cells, freight trains, aircraft, etc.) will be impacted by the NWT, all driven by actuators. Five key trends can be found for the future perspectives: “Performance to Reliability”, “Hard to Soft”, “Macro to Nano”, “Homo to Hetero” and “Single to Multi functional”. We invite papers that primarily impact these economic sectors; those illustrating basic scientific principles are also welcome.

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