Open Invited Track for IFAC World Congress 2020
Advances in Nonlinear Observers

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Abstract: Observation problems are fundamental for control, diagnosis and systems operation. Despite of important advances in the last 60 years the observability analysis and the design of nonlinear observers for linear or nonlinear systems remain challenging tasks. The objective of this open invited track is to present recent results on the design of observers for nonlinear systems, for estimation and control purposes and their applications.

1. WORKSHOP OUTLINE

To analyze, monitor or control physical or biological phenomena, the first step is to provide a mathematical modeling in the form of mathematical equations that describe the evolution of the system variables. Some of these variables are accessible through measurement and others are not. One of the problems in control engineering is that of designing algorithms to provide real time estimates of the unmeasured data from other measured variables. These estimation algorithms are called state observers and can be found in many devices. This need for internal information can be motivated by various purposes: modeling (identification), monitoring (fault detection), or driving (control) the system. All those purposes are actually jointly required when aiming at keeping a system under control.

This open invited track aims at the development of new observer design techniques and their application. The topics include therefore the analysis and the design of observer/estimator for systems governed by nonlinear differential or difference equations comprising many classes of dynamical systems, such as continuous-time, sampled-data or hybrid systems; the use of nonlinear observers in various contexts such as output feedback stabilization, regulation or identification; the experimental validation of observers/filters in real applications.

2. SPONSORING TC

We suggest the TC 2.3. Non-Linear Control Systems for the organization of the reviewing process. Many members of this TC are working in the field of this open invited track, thus it is expected that the review process will be very natural.

3. LIST OF ORGANIZERS WITH A SHORT BIO

Daniele Astolfi received his Ph.D. degree in control theory in 2016 from the University of Bologna, Italy, and from Mines ParisTech, France, in a joint program. From 2016 to 2017, he has been a Research Assistant at the University of Lorraine (CRAN), Nancy, France. Since 2018, he is a CNRS Researcher at LAGEPP, Lyon, France. His research interests include observer design, and output regulation for nonlinear systems, networked control systems, hybrid systems, and multi-agent systems. He was a recipient of the 2016 Best Italian Ph.D. Thesis Award in Automatica given by SIDRA. Since 2018, he serves as associate editor of the IFAC journal Automatica.

Vincent Andrieu graduated in applied mathematics from INSA de Rouen, France, in 2001. After working in ONERA (French aerospace research company), he obtained a PhD degree from Ecole des Mines de Paris in 2005. In 2006, he had a research appointment at the Control and Power Group, Dept. EEE, Imperial College London. In 2008, he joined the CNRS-LAAS lab in Toulouse, France, as a CNRS researcher. Since 2010, he has been working in LAGEPP-CNRS, Universitè de Lyon 1, France. In 2014, he joined the functional analysis group from Bergische Universität Wuppertal in Germany, for two sabbatical years. His main research interests are in the feedback stabilization of controlled dynamical nonlinear systems and state estimation problems. He currently serves as senior editor for Systems & Control Letters and associate editor for IEEE Transactions on Automatic Control.

Lorenzo Marconi graduated in 1995 in electrical engineering from the University of Bologna. Since 1995 he has been with the Department of Electronics, Computer Science and Systems at University of Bologna, where he obtained his Ph.D. degree in 1998. From 1999 he has been an assistant professor in the same department where he is now a full professor. He has held visiting positions at various academic/research international institutions. He is a co-author of more than 250 technical publications on the subject of linear and nonlinear feedback designs published on international journals, books and conference proceedings. In 2005, he received the Outstanding Application Paper Award" from IFAC for a coauthored paper published on Automatica. He is also the co-recipient of the 2014 IEEE Control Systems Magazine Outstanding Paper Award for the best paper published in the magazine in the period 2012–2013 and of the 2018 O. Hugo Schuck Best Paper Award. He is Fellow of IEEE for contributions to feedback design of nonlinear systems and unmanned aerial vehicles. He currently serves as senior editor of IEEE Transactions on Automatic Control.