State Estimation in the Presence of Sporadic Measurements: A Hybrid Systems Approach

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17 July 2018
Seminar Room, h. 14:30
Polo scientifico-tecnologico Fabio Ferrari – via Sommarive 9 - Trento

Abstract:
In this talk, we consider the problem of exponentially estimating the state of continuous-time Lipschitz nonlinear systems subject to external disturbances and in the presence of sporadic measurements, i.e., we assume the plant output to be sampled with a bounded nonuniform sampling period, possibly very large.

To address this problem, we propose an observer with a continuous intersample injection and state resets. Such an intersample injection is provided by a linear time-invariant system, whose state is reset to the measured output estimation error at each sampling time. The resulting system is augmented with a timer triggering the arrival of a new measurement and analyzed in a hybrid system framework. The design of the observer is performed to achieve exponential convergence with a given decay rate of the estimation error. Robustness with respect to external perturbations and L_2-external stability from plant perturbations to a given performance output are considered. Computationally efficient algorithms based on the solution to linear matrix inequalities are proposed to design the observer.

Biosketch:
Francesco Ferrante received in 2010 a “Laurea degree” (BS) in Control Engineering from Università La Sapienza, Rome, Italy and in 2012 a “Laurea Magistrale” degree (MS) in Control Engineering from Università Roma Tor Vergata, Rome, Italy. In 2015, he received a PhD degree in Control Theory from Institut Supérieur de l’Aéronautique et de l’Espace (SUPAERO) Toulouse, France. From 2015 to 2017, he held postdoctoral positions at the Department of Electrical and Computer Engineering at Clemson University and at the Department of Computer Engineering at University of California Santa Cruz. In September 2017, he joined the University of Grenoble Alpes and the Grenoble Image Parole Signal Automatique Laboratory, where he is currently an assistant professor. He is the recipient of the “Best Ph.D. Thesis Award 2017” from the Research Cluster on Modeling, Analysis and Management of Dynamical Systems (GDR-MACS) of the French National Council of Scientific Research (CNRS). His research interests are in the general area of systems and control with a special focus on hybrid systems, observer design, and application of convex optimization in systems and control.

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