Altin Berk

Feedback Control Algorithms for High-Confidence Autonomy of Cyber-Physical Systems

Abstract

Cyber-physical systems (CPS) are engineered systems wherein the physical components and the computational platforms controlling them are tightly integrated. Examples abound in various application areas such as robotics, autonomous vehicles, energy systems, and healthcare. Advancement of CPS science is the key to enabling smart machines of tomorrow and transforming our society. However, complex phenomena arising from the interaction between hardware and software, as well as stringent performance requirements driven by user demands across the spectrum of applications make this a challenging task.

This talk introduces a powerful hybrid systems framework that is uniquely suited to advance CPS science in the control front. I show that by unifying complex continuous- and discrete-time dynamics, challenging performance requirements can be realized in a safety-critical setting, despite inevitable hardware limitations and failures. In particular, I demonstrate how to design high-performance feedback controllers in the presence of unpredictable and large computational delays, with quantifiable margins. I illustrate similar results guaranteeing robustness under intermittent sampling, data dropouts, and actuator dynamics. I then show how to design stabilizing predictive control algorithms for high-dimensional hybrid dynamics, which emerge naturally in walking robots and power conversion circuits. Finally, I explain how these new results pave the road to solve key CPS design challenges.

Biography

Berk Altın received his B.S. in Mechatronics from Sabancı University in 2011, Istanbul, Turkey in 2011. From 2011 to 2016, he attended the University of Michigan, Ann Arbor, as a Fulbright fellow, where he received the M.S. and Ph.D. degrees in Electrical Engineering: Systems, and the M.S. degree in Mathematics, in 2013, 2016 and 2016, respectively. He is currently employed as a postdoctoral researcher at the University of California, Santa Cruz, with the Hybrid Systems Laboratory. His primary research interests include hybrid systems, model predictive control, iterative learning control, repetitive processes, and multidimensional systems, with applications in cyber-physical systems, power systems, robotics, and additive manufacturing.

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Seminar: 11:10 a.m. – 12:00 p.m.
* Vision Talk: 12:00 p.m. – 12:30 p.m.

*Faculty Only

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