# SmartGridLab+: A Software-Hardware Hybrid Smart Grid Testbed

Song Tan[*], Wen-Zhan Song[*], Steve Yothment[†], and Lang Tong[§]

[*]Department of Computer Science, Georgia State University, GA, USA

[†]Senior Electrical Engineer, Panasonic Automotive Systems of America, USA

[§]School of Electrical and Computer Engineering, Cornell University, NY, USA

**Abstract**

Smart Grid is a complex cyber-physical system that modernizes the traditional electric power infrastructure by sensing, control, computation and communication. Validating the functionality, security and reliability of Smart Grid applications within such a system requires the modeling and simulation of both power and information networks, as well as the interactions between them. SmartGridLab+, a software-hardware hybrid smart grid testbed, has been designed for that. It simulates both power and information networks, and integrates hardware testbeds with software simulators, such that they all follow same architecture and interfaces and a virtual node in software simulator can interact with a real node in testbed. Multiple SmartGridLab+ testbed can also be connected on demand in remote. With this integration, we may examine real system performance under realistic communication and computation constraints in hardware testbed, while evaluating algorithm scalability in software simulators at the same time.