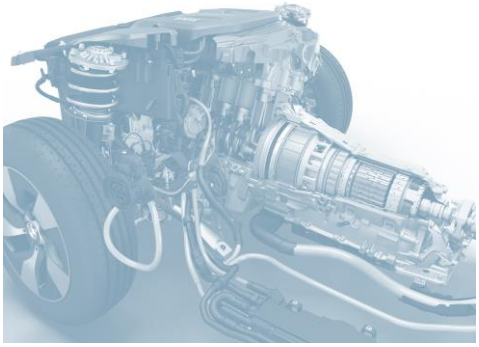
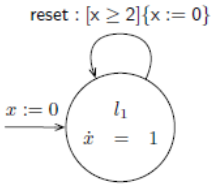
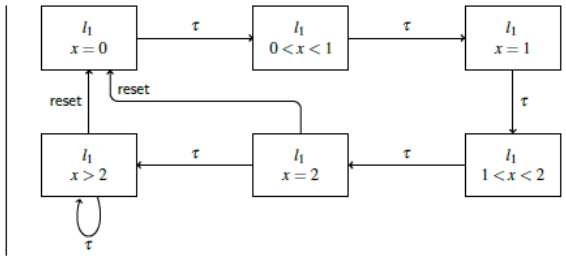
ECE/CS 584: Spring 2016

# Embedded and Cyber-physical System Verification

**URL:** http://mitras.ece.illinois.edu/ECE584/index.shtml
**Location:** 4026 ECEB
**Time:** Tuesdays and Thursdays 11-12:20PM
**Instructor:** Prof. Sayan Mitra (mitras@illinois.edu)






**About the course.** Embedded systems or cyber-physical systems (CPS), combine software components with sensors, actuators & communication. Smart driver-assist systems in cars, smart meters, air-traffic control systems are all examples of CPS. This synergy of computation and control is enabling creation of new products and brings new challenges. This course is about learning the foundations of CPS. Learn to **model** and **analyze** CPS, learn about latest **software tools** (model checkers, SMT solvers, & theorem provers) for designing & analyzing systems, read and discuss recent ideas from research papers.

**Administrivia.** The course meets twice a week, has **4-5 home works**, and a semester-long project. All reading material will be available online. Projects typically lead to conference papers. We will provide project ideas, but you are also welcome to design a project around your own research. Sample past projects: Build/verify a system with Android phones & mobile robots, build a verification tool and try it on benchmarks, analyze new case studies on new CPS. More samples available in the course archives.

**Tentative topics:** • Review of Automata, languages, invariant proofs, linear systems, and stability • Models for discrete time, synchronous, and asynchronous, distributed systems • model checking • Real-time and hybrid system models, stability, Lyapunov functions, dwell time, abstractions, simulations • Abstraction and refinement • Undecidability and limits of algorithmic analysis and verification • Deductive verification & mechanical theorem provers • Applications to synchronization, path planning in robotics, supervisory control, biology •

**Register soon!**