Course Description in English

The digital technology revolution brought a need for techniques that allow guaranteeing that embedded computer systems satisfy safety and performance requirements. The main challenge is in analyzing the combination of discrete and continuous dynamics that we witness in modern computerized control systems, e.g., airplanes, industrial robots, medical machines, etc.
Hybrid systems, also called Cyber Physical Systems (CPS), are dynamical systems with an interaction of continuous dynamics (modelled as differential equations) and discrete dynamics (modelled with automata). Engineers use such models in CAD, in developing embedded software, in robotics and automation, aeronautic, and in automation and control. Hybrid systems also serve as an important tool for research in control theory, formal methods, and AI. Recent research has brought us methods for analysis, synthesis, and simulation of hybrid models.

The course will survey topics on modelling, analysis, control and verification including:

- Discrete and continuous models
- Safety specifications and verification algorithms
- Lyapunov stability analysis
- Numerical simulations
- Examples from real engineering applications

The course does not assume prior knowledge in continuous mathematics and differential equations beyond the one thought in the standard CS program and specified in the prerequisite courses.

**ספרות המקור**

- P. Tabuada, Verification and control of hybrid systems: a symbolic approach, 2009
- D. Liberzon, Switching in systems and control, Birkhauser, 2003
- J. Lygeros, Lecture notes on hybrid systems, 2003