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Hybrid Systems II

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Preface

Hybrid Systems are models for networks of digital and continuous devices, in which digital control programs sense and supervise continuous and discrete plants governed by differential or difference equations. Modern industrial society is filled with hybrid systems used for such varied purposes as aircraft control, computer synchronization, manufacturing, communication networks, traffic control, industrial process control, etc. Hybrid systems also provide the basic framework and methodology for the synthesis and analysis of autonomous and intelligent systems. Examples in this area include medical informatics systems, highway control and routing systems, robotics, and database management and retrieval systems.

In addition, hybrid systems theory provides the backbone for the formulation and implementation of learning control policies. In such policies, the control acquires knowledge (discrete data) to improve the behavior of the system as it evolves in time.

Hybrid Systems has become a distinctive area of study due to opportunities to improve on traditional control and estimation technologies by providing computationally effective methodologies for the implementation of digital programs that design or modify the control law in response to sensor detected events, or as a result of learning.

The areas of science and engineering that can be brought to bear on the issue of hybrid control are numerous. These include mathematical disciplines such as functional analysis, variational calculus, ordinary differential equations, linear partial differential equations, Lie algebras, differential geometry, dynamical systems; operations research disciplines such as linear and integer and non-smooth mathematical programming; engineering disciplines such as linear and optimal and intelligent control, stochastic processes, stochastic approximation, discrete event simulation; computer science disciplines such as distributed and agent-based systems, automata theory, and program validation and verification; and branches of mathematical logic and applied logic such as logic programming. We are gradually gaining an understanding of the subtle interplay of mathematical and physical disciplines involved in hybrid systems. The investigation of hybrid systems is creating a new and fascinating discipline bridging mathematics, control engineering, and computer science.

The first workshop on Hybrid Systems was held at the Mathematical Sciences Institute (MSI) of Cornell University June 10-12, 1991. The second workshop was held at the Technical University in Lyngby, Denmark, October 19-21,1992 and inspired the volume *Hybrid Systems* (Springer Lecture Notes in Computer Science 736, Grossman, Nerode, Rischel, Ravn, eds., 1993). The third workshop was held at MSI on October 28-30, 1994 and resulted in this volume, which consists of fully refereed papers.

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