

# DISCRETE EVENT SYSTEMS

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ETH Zurich – Distributed Computing – [www.disco.ethz.ch](http://www.disco.ethz.ch)

# Chapter 0 INTRODUCTION

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## Organization Matters

- Lecture
  - Thu, 1-3, ETZ E9
  - Christoph Stamm
- Exercises
  - Thu, 3-5, ETZ E9
  - Tobias Langner, Jochen Seidel, Klaus-Tycho Förster
- Course Material
  - Check [www.disco.ethz.ch](http://www.disco.ethz.ch) → courses 

## Some Comments

- **English vs. German** language
- Course material **pretty stable**
  - Slides/material on web site before lecture...
- **Differences** to last year's course
  - A few new things... a few things dropped...
- **ITET** vs. other types of students...

## Course Overview

- Part 1: Theory of Coke Vending Machines
  - Automata and Languages
  - Discrete Event Systems (DES) Models
- Part 2: Theory of Standing in a Line
  - Stochastic Processes
  - Markov Chains, Queuing Theory
  - Average-Case Analysis of DES
- Part 3: Theory of Renting Skis
  - Online Algorithms
  - Worst-Case Analysis of DES
- Plus a few smaller parts



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## Motivation: Physics

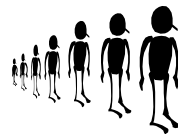
- Science is often based on natural phenomena
- Laws of physics: mechanics, gravitation, electrodynamics
- Continuous variables for mass, velocity, power, etc.
- Can be solved by differential equations



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## Motivation: Discrete Events

- Some complex systems are not [primarily/only] continuous
  - Computer systems
  - Communication networks
  - Business processes (“workflow”)
  - Transportation systems
  - Software
- Instead systems are determined by discrete events
  - Telephone calls
  - Customers arrivals
- Many variables we are interested in are discrete
  - „How many ...?”



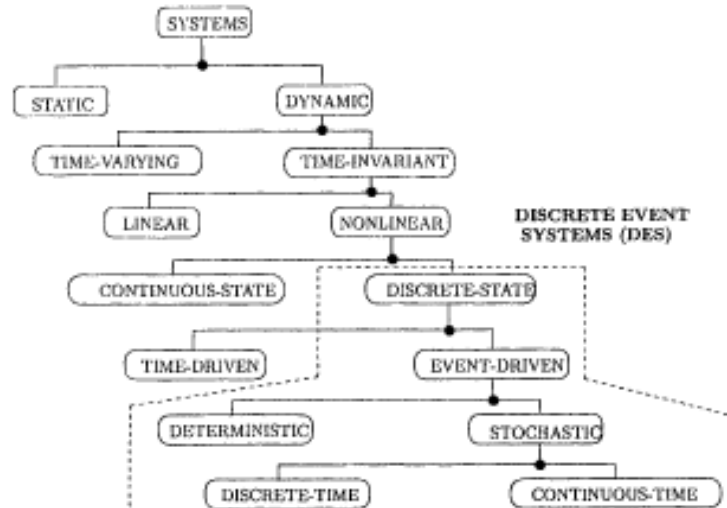
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## Motivation: Discrete Event Systems

- System models
  - Find the right level of detail to model a real system
  - “Make everything as simple as possible, but not simpler”
- Correctness verification
  - Formal specification
  - Testing
  - Simulation
- Analysis and Optimization



## Motivation: System Classification



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## Literature

- Christos G. Cassandras, Stephane Lafortune. Introduction to Discrete Event Systems. Kluwer Academic Publishers, 1999.
- **Part 1**
  - Michael Sipser. Introduction to the Theory of Computation. PWS Publishing, 1997. (Chapters 1 and 2)
- **Part 2**
  - Thomas Schickinger, Angelika Steger: Diskrete Strukturen, Band 2. Springer, 2001. (Chapters 1, 2, and 4)
  - Dimitri Bertsekas, Robert Gallager. Data Networks. Prentice Hall, Upper Saddle River, NJ, 1992. (Chapter 3)
- **Part 3**
  - Allan Borodin, Ran El-Yaniv. Online Computation and Competitive Analysis. Cambridge University Press, 1998. (Selected Chapters)
- Plus research papers...

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