



Programme of Course "Automazione Industriale"

- Code: I0649
- Type of course unit: Elective (Laurea in Ingegneria dell'Informazione curriculum Automatica)
- Level of course unit: Undergraduate Degrees
- Semester: 2

Number of ects credits: (Laurea in Ingegneria dell'Informazione) 6 (workload 150 hours)

Teachers: Giordano Pola

| | | |
|---|--|---|
| 1 | Course objectives | The aim of the course is to provide basic knowledge of discrete event systems and to show how they can be used for the analysis of performances in industrial systems. |
| 2 | Course content and learning outcomes (dublin descriptors) | <p>Topics of the module include:</p> <ul style="list-style-type: none"> • Systems and Models: System and control basics: The Concept of System, The Input–Output Modeling Process, The Concept of State, The State Space Modeling Process, Sample Paths of Dynamic Systems, State Spaces, The Concept of Control, The Concept of Feedback, Discrete-Time Systems. Discrete event systems: The Concept of Event, Characteristic Properties of Discrete Event Systems, The Three Levels of Abstraction in the Study of Discrete Event Systems, Examples of Discrete Event Systems, Hybrid Systems • Languages and Automata: The concepts of Languages and Automata: Language Models of Discrete-Event Systems, Automata, Languages Represented by Automata, Nondeterministic Automata, Automata with Inputs and Outputs. Operations on Automata: Unary Operations, Composition Operations, State Space Refinement, Observer Automata, Equivalence of Automata. Finite-state Automata: Definition and Properties of Regular Languages, Regular Expressions, State Space Minimization Analysis of discrete-event systems: Safety and Blocking Properties, Partially-Observed DES, Event Diagnosis, Software Tools and Computational Complexity Issues, Formal Verification and Model Checking • Supervisory Control: Feedback control with supervisors: Controlled Discrete Event Systems, Control Under Partial Observation Specifications on control systems: Modeling of Specifications as Automata, The Need for Formal Methods Control with partial controllability: Controllability Theorem, Realization of Supervisors, The Property of Controllability, Some Supervisory Control Problems and Their Solutions, Computation of K/c Nonblocking control: Nonblocking Controllability Theorem, Nonblocking Supervisory Control, Computation of K/C: General Case, Dealing with Blocking Supervisors Control with modular specifications Control under partial observation: Controllability and Observability Theorem, Realization of P-Supervisors, The Property of Observability, Supervisory Control Problems Under Partial Observation, The Property of Normality Decentralized control: Conjunctive Architecture, Disjunctive Architecture, Combined Architecture, Realization of Decentralized Supervisors, The Property of Coobservability, Undecidability in Decentralized Control |
| 3 | Course prerequisites | None |
| 4 | Teaching methods and language | <p>Lectures and exercises.</p> <p>Language: Italian</p> <p>Reference textbooks</p> <ul style="list-style-type: none"> • Cassandras, Lafortune, <i>Introduction to Discrete Event Systems</i>. Springer. 2007. |
| 5 | Assessment methods | Written and oral exam. |