

# Introduction to Formal Methods

## Chapter 00: Course Overview

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# Target

- The course will be given **in English**.
- The course is intended for 1<sup>st</sup> or 2<sup>nd</sup> year M.S. students in computer science ("corso di laurea magistrale in informatica"), but it is open to whoever may be interested, in particular to PhD students of ICT school.

# Requirements

- A background knowledge on the following topic is **strongly** advisable for the course:
  - Boolean logic
- Some background knowledge on the following topics is advisable for the course:
  - automata & formal languages
  - basic algorithms and data structures
  - SW engineering

# Motivations & Goals

- Formal methods are increasingly used as powerful **specification**, **verification** and **early debugging** methods in the development of industrial SW and HW systems.
- This course provides an introduction to Formal Techniques and Tools for the specification and verification of Hardware and Software platforms.
- The course will concentrate mainly on formal validation and verification and, in particular, on **Model Checking (MC)**.
- A laboratory will be given in which the students will experience MC techniques by means of the MC **NuXMV**.

# Topics

## FM Course:

- Introduction on formal techniques and their benefits
- Formal specification & formal validation
- Model Checking (MC)
- Temporal logics: LTL & CTL
- Ordered Binary Decision Diagrams (OBDDs)
- Explicit-State MC, LTL MC
- Symbolic MC, CTL MC
- SAT-based MC
- More advanced developments:
  - Abstraction in MC
  - MC with Timed and Hybrid Systems

## Topics (cont.)

### Laboratory:

- The MC NuXMV
- Modeling and verifying systems with NuXMV

# References

- Notes from the lessons
- Slides (available from the URL of the course)
- Other material (available from the URL of the course)
- The NuXMV manual
- Suggested books (in alternative):
  - *Edmund Clarke, Orna Grumberg and Doron Peled.*  
"Model Checking"  
MIT Press
  - *Christel Baier and Joost-Pieter Katoen .*  
"Principles of Model Checking"  
MIT Press

# Disclaimer

Some of the material presented in these slides (text, figures) is courtesy of the following people, listed in alphabetical order:

- **Massimo Benerecetti** (`bene@na.infn.it`)
- **Alessandro Cimatti** (`cimatti@fbk.eu`)
- **Paritosh Pandya** (`pandya@tifrr.res.in`)
- **Marco Pistore** (`pistore@disi.unitn.it`)
- **Marco Roveri** (`roveri@fbk.eu`)
- **Stefano Tonetta** (`tonettas@fbk.eu`).

Furthermore, some examples are taken from the book:

[E. Clarke, O. Grunberg & D. Peled, “Model Checking”, MIT Press]



# Timetable & Office Hours

**Timetable:** 2<sup>nd</sup> Semester, February 17<sup>th</sup>-May 29<sup>th</sup>

- CLASS: Tuesday 11.30-13.30 Room A203
- CLASS: Thursday 14.30-17.30 Room B105
- LAB: Friday 09.30-11.30 Room A202

**Office hours:**

- no weekly fixed-day
- anytime in the week, upon appointment
- appointments to be set in class or via email
- Office hours only during class period (see above)!

# Exam

2 parts:

- Script
  - a lab part on NuXMV
  - the script test, on the topics of the course
- Oral Interview
  - interview on the topics of the course.

N.B.: students from the previous year(s) having already their lab or script part passed/approved can skip the lab or part part respectively.

To copy at exams very dangerous is!

