Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Applied Formal Methods
Code der Lehrveranstaltung	71088
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	INFO-01/A
Sprache	Englisch
Studiengang	Doktoratsstudium in Informatik
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	dr. Andrea Mazzullo, Andrea.Mazzullo@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38537
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	2026/27
KP	2
Vorlesungsstunden	20
Laboratoriumsstunden	0
Stunden für individuelles Studium	50
Vorgesehene Sprechzeiten	
Inhaltsangabe	The students will develop a deep understanding of technologies based on applying formal methods for the specification and verification of hardware systems. The students will learn the most important techniques based on Model Checking to check the properties of a system. In particular, the students will be able to understand how to formally specify a hardware system by means of transition systems and how to express computation properties

	by means of formulas in Temporal Logic. Both Linear Temporal Logic (LTL) and Computation Tree Logics (CTL and CTL*) will be studied. A tutorial on NuSMV will introduce the students to one of the most successful software used in industrial applications to specify and test synchronous concurrent systems and critical software.
Themen der Lehrveranstaltung	• Modeling systems as transition systems • Temporal logics: LTL, CTL, CTL* • Model checking of temporal formulas • NuSMV to model systems and perform model checking
Stichwörter	Model Checking, Transition Systems, Temporal Logics
Empfohlene Voraussetzungen	
Propädeutische Lehrveranstaltungen	A background on propositional logic is welcome.
Unterrichtsform	Frontal lectures
Anwesenheitspflicht	Not compulsory but recommended. Non-attending students have to contact the lecturer at the start of the course to agree on the modalities of the independent study
Spezifische Bildungsziele und erwartete Lernergebnisse	Knowledge and understanding • Knowledge of model checking principles and of temporal logics used in applications. Applying knowledge and understanding • To be able to model systems and specify desired properties using transition systems and LTL/CTL formulas. • To be able to use the NuSMV model checker to specify a system and verify temporal properties. Making judgments • To be able to understand the expressivity and the limitations of the temporal formalisms. • To be able to interpret and assess the model checking outputs and counterexamples. Communication skills • To be able to present technical content (project descriptions, research articles) in advanced academic English.

	• To be able to synthesize knowledge from scientific and technical documentation, and to prepare reports and presentations. Learning skills • To be able to independently read, understand, and produce scientific and technical documentation on formal methods.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	To pass the course each student should develop and present either: (A) a small project using the model checker NuSmv; or (B) a set of slides on a topic or research article relevant to the course contents.
Bewertungskriterien	The exam is assessed on a pass/fail basis and is based either on: (A) a NuSMV project delivered and presented at the end of the course; (B) a presentation of a research article or topic relevant to the course contents. The assessment considers the following criteria: - Clarity and effectiveness of communication. - Ability to summarize, critically evaluate, and establish connections between topics. - Ability to apply the tools, methods, and processes introduced during the course to specific cases. The same evaluation criteria apply to non-attending students.
Pflichtliteratur	• Principles of Model Checking. Christel Baier and Joost-Pieter Katoen. MIT Press, 2008.
Weiterführende Literatur	• Logic in Computer Science -- Modelling and Reasoning about Systems. Michael Huth and Mark Ryan. Cambridge University Press, 2004 (second edition). • Model Checking. E. Clarke, O. Grumberg, D. Kroening, D. Peled, and H. Veith. MIT Press, 2018 (second edition).
Weitere Informationen	NuSMV (to be downloaded from: https://nusmv.fbk.eu/)
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung