

EE-433

Hardware systems modeling II

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Cursus	Sem.	Type
Computer engineering minor	E	Opt.
Electrical and Electronical Engineering	MA2, MA4	Obl.
Mineur STAS Chine	E	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	14
Hours	2 weekly
Courses	2 weekly
Number of positions	

Summary

Creation and use of models of analog and mixed-signal hardware systems at various levels of abstraction. Use of the VHDL-AMS hardware description language.

Content**Introduction**

Models in electronic mixed-signal design automation. Mixed-signal hardware description languages. Analog and mixed-signal simulation techniques.

The VHDL-AMS language

VHDL-AMS characteristics (language, design flow, modeling guidelines). VHDL-AMS model organization. Behavioural and structural VHDL-AMS modeling.

Modeling of analog and RF components

Electrical primitives. Operational amplifier, OTA. Filters. RF building blocks. Use of discrete-event modeling techniques. Testbenches and verification techniques.

Modeling of mixed-signal components

A/D and D/A interfaces. A/D and D/A converters. Testbenches and verification techniques.

Keywords

Mixed-signal system, continuous-time model, behavioral modeling, VHDL-AMS.

Learning Prerequisites**Required courses**

Hardware systems modeling I (EE-432).

Recommended courses

Digital systems design (EE-334).

Important concepts to start the course

VHDL modeling. Circuits and systems.

Learning Outcomes

By the end of the course, the student must be able to:

- Exploit mixed-signal modeling techniques.
- Develop reusable models at various levels of abstraction.
- Produce quality and reusable VHDL-AMS models.

Teaching methods

Lecture with integrated exercises.

Expected student activities

Attending lectures. Completing exercises. Use of state-of-the-art electronic design automation (EDA) tools.

Assessment methods

Homework exercises (10%). Midterm examination (40%). Final examination (50%).

Supervision

Office hours	No
Assistants	Yes
Forum	Yes
Others	Individual feedback comments on delivered work in the Moodle page of the course.

Resources

Bibliography

P. Ashenden, G. Peterson, and D. Teegarden, *The System Designer's Guide to VHDL-AMS*, Morgan Kaufmann, 2002.

R. Frevert, J. Haase, R. Jancke, U. Knöchel, P. Schwarz, R. Kakerow, and M. Darianian, *Modeling and simulation for RF system design*, Springer, 2005.

F. Pêcheux, C. Lallement, and A. Vachoux, *VHDL-AMS and Verilog-AMS as alternative hardware description languages for efficient modeling of multidiscipline systems*, IEEE Trans. on Computer-Aided Design of Integrated Circuits and Systems, vol. 24, pp. 204-225, 2005.

Ressources en bibliothèque

- [Modeling and simulation for RF system design / Frevert](#)
- [VHDL-AMS and Verilog-AMS / Pêcheux](#)
- [The System Designer's Guide to VHDL-AMS / Ashenden](#)

Notes/Handbook

Lecture notes, VHDL-AMS syntax summary.

Websites

- <http://en.wikipedia.org/wiki/VHDL-AMS>
- <http://www.eda.org/twiki/bin/view.cgi/P10761/WebHome>

Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=233>