

# Thibault Hilaire

Associate Professor

(Maître de Conférences)

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## Short resume

I am associate professor (maître de conférence) at Pierre and Marie Curie University (Sorbonne Universités) since 2009.

I am teaching in the engineering school Polytech'Paris UPMC, mainly in computer science (but I have also taught analog and digital electronic, signal processing, etc.), for graduate and undergraduate students.

I am doing my research in Computing Science lab of the university (LIP6), in a team named Pequan (*Performance and Quality of Numerical Algorithms*). My researches are mainly focused on implementation issues with arithmetic errors due to the finite precision in mind.

## Experiences

- 09/09 – now **Associate Professor (Maître de conférences)**, Université Pierre et Marie Curie (UPMC).  
Research in Computing Science lab (LIP6), teaching in the engineering school Polytech'Paris-UPMC  
*From filters/controllers to code with finite-precision arithmetic*
- 09/08 – 08/09 **Postdoc**, Institute of Technology, Wien University, Austria.  
*Design methodology: Distributed implementation of signal processing algorithms, with hardware considerations*
- 06/08 – 08/08 **Short period research**, University of Tsukuba, Japan (Graduate School of Systems and Information Engineering).  
*Arithmetic operators for pairing-based cryptography (elliptic curves)*
- 09/07 – 05/08 **Research and Teaching assistant (ATER)**, IUT (university technology institute) of Lannion, France.  
Research in the R2D2-team, from IRISA (joint research centre for Informatics)  
*Fixed-point implementation of signal processing algorithms*
- 09/06 – 08/07 **Post-Doc**, funded by INRIA (National Institute for Research in Computer Science and Control).  
*Fixed-point arithmetic computing for control and signal processing algorithms*
- 02/06 – 08/06 **Research engineer**, ARMINES.  
(software development linked to my PhD research)
- 02/03 – 01/06 **Research engineer**, PSA Peugeot-Citroën, during my PhD.
- 04/02 – 08/02 **Master internship**, Polytechnic University of Catalonia, Barcelona (Department of Computer Architecture).  
*Hardware Architecture Description Language — application to the ALPHA 21264 processor*

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## Education

02/03 – 06/06 **PhD thesis**, *University of Nantes*.

Institut of Research in Communications and Cybernetics of Nantes (IRCCyN), involved in both *real time* and *control* teams. Funded by PSA Peugeot-Citroën:

*Analysis and Synthesis of the Finite Word Length Implementation of linear controllers or filters — Application to embedded automotive control*

09/01 - 09/02 **MSc (DEA)**, Control and Applied Computing Science, *from Université de Nantes*. Training period (5 months) at Polytechnic University of Catalonia, Barcelona:

*A Hardware Description Language – application to the Alpha 21264 proc.*

1998 - 2002 **Engineer diploma**, *École Centrale de Nantes (french A+ Grande École)*.

*Control and embedded systems*

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## Research interest

My researches are mainly focused on implementation issues with arithmetic errors due to the finite precision in mind. More precisely, we want to transform some mathematical objects (mainly signal processing or control) into code (into software running on a given processor, or into dedicated hardware operator), and to guaranty a certain level of numerical performance (typically the output error between the mathematical object and the implemented code is less than a given threshold). For that purpose, we consider:

- the possible arithmetic transformation applied on the original algorithm (like computations reorganization, various equivalent computing structures, etc.)
- the possible orders of operations, since the finite precision operations may not be always associative and distributive
- the various word-lengths for each coefficients and operator (specially for HW targets, like FPGAs or ASICs)

A rigorous error analysis is performed, and we try to provide a full design flow from filters/controllers to code, in order to produce efficient and reliable implementation of initial mathematical objects. These research combines theories, tools and technics from signal processing/control, computer arithmetic and computer science.

**Publications:** 7 journals and 23 international conferences

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## Software

I have developed several softwares, for my researches, my teaching or my personal interest:

- FWRToolbox: a Matlab toolbox used to analyse the Finite Word Length effects of digital filters/controllers implementations and find 'optimal' realizations ;
- FiPoGen: a fixed-point arithmetic code generator ;
- makeCourse: a *make*-like tool to generate courses documents (slides, tutorials, etc.) from xml description of the course ;
- Coding Game Server: a server used to propose coding games for pedagogic purposes (to teach algorithms, languages and programming);

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## Awards

- I have receive the *Prime d'Investissement Recherche* from Université Pierre et Marie Curie (competitive bonus for involvement in excellent research) for 2016-2019.