Damien Couroussé

Research Engineer
Embedded Software and Embedded Security

Research interests — I am interested in embedded software and its interaction with hardware: Compilers, interpreters and runtime code generation for performance and cyber-security purposes, Countermeasures against side-channel attacks and fault injection attacks, Hardware and software co-design for secure processor design.

Experience

2011–now **Research Engineer**, *CEA*, Grenoble, France.
Leading a team of 6-8 people, in a highly pluri-disciplinary environment, for a large French RTO. Design of Software and Hardware countermeasures for hardware security.

- Project coordination of research collaborative projects: COGITO (ANR 2013-2017), CLAPs (IRT NanoElec, Pulse program, 2018-2020); Work-package leader in a large european project: SERENE-IoT. I was involved in many French and European Research Projects involving academics and industrial parties.
- Co-author of scientific publications in the fields of embedded software, side-channel attacks, fault-injection attacks, compilation, runtime code generation, high-performance embedded software, micro-architecture software optimizations.
- Co-inventor of 6 patents (3 others pending).
- Supervised 3 Ph.D students, 3 post-doc students, 4 research engineers, 16 masters students.
- External reviewer for international conferences: DAC, DATE.

2009–2010 **Technical Expert**, *Logica*, Grenoble, France, Principal engineer in an 'embedded software' team.

- Scientific contributor to two European research projects. Representative person for Logica.
- For STMicroelectronics Grenoble: For Set-Top Boxes, prototyping a resource manager with kernel (Linux, RT-OS) and userland APIs. Porting of a test framework for a video middleware.
- For Gorgy Timing: Development of a Linux driver for a PHY ethernet component, for high-resolution clocks distributed over networks.
- Building answers to requests for proposals, training and mentoring of Junior engineers.

2004–2008 **PhD student & Research Engineer**, *ICA Laboratory*, Grenoble, France.

- Design and implementation of a real-time multi-sensory simulator (haptics, sound and image) of mechanical objects, as a research and creation platform for instrumental interaction
  - Software development of a multi-sensory simulator Real-time programming (DSP TI-C67x), systems programming (C, Linux, ADC/DAC), graphics programming.
  - Psychophysics experiments, in collaboration with Gunnar Jansson, Professor Emeritus at Uppsala Univ., Sweden.
- Research collaborator and assistant of the deputee coordinator in a large european research project: Enactive Interfaces (consortium of 26 members).
- Participation to a startup project (Ergos Technologies): software deliveries, user trainings and user support. Design of demonstrators.

2004–2008 **Teaching Assistant**, *Univ. Pierre-Mendès France*, Grenoble, France, (*moniteur*, *ATER*).
Computer architecture, operating systems, networks, analysis and modeling of information systems.

2003–2002 **Software Engineer**, *ICA Laboratory*, Grenoble, France.
Development of a Linux driver for a PCI acquisition board including an on-board DSP.

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Education

2004–2008 **Ph.D(Tech)**, *INPG*, Grenoble, France, Art, Sciences and Technologies, with honors..
Research director: Annie Luciani, Scientific supervisor: Jean-Louis Florens.

2002–2003 **DEA Sciences Cognitives**, *(Master's Degree)*, INPG, Grenoble, France, *Mention Très-Bien*.

1997–2002 **Master's Degree**, *Engineering diploma. Electronics & Communication Systems*, INSA, Rennes, France.

Programming skills

Programming C, Haskell, C++, assembly (ARM, RISC-V), Python, Systems programming (Linux, baremetal)

Selected publications

I have co-authored 4 journal articles, 8 contributions to scientific books, chapters & booklets, 25 papers in international conferences, peer-reviewed with proceedings, 12 contributions to international workshops with peer-reviewed selection. I gave 8 invited talks or keynotes.
I am the co-inventor of 6 patents; 3 other patent applications are pending.

Compilation of software countermeasures against side-channel and fault injection attacks

- Nicolas Belleville, Damien Couroussé, Karine Heydemann, and Henri-Pierre Charles. "Automated Software Protection for the Masses Against Side-Channel Attacks". In: *ACM TACO* 15.4 (Jan. 2019), 47:1–47:27
- Nicolas Belleville, Karine Heydemann, Damien Couroussé, Thierno Barry, Bruno Robisson, Abderramane Seriai, and Henri-Pierre Charles. "Automatic Application of Software Countermeasures Against Physical Attacks". In: *Cyber-Physical Systems Security*. Springer, Dec. 2018, pp. 135–155
- Thierno Barry, Damien Couroussé, and Bruno Robisson. "Compilation of a Countermeasure Against Instruction-Skip Fault Attacks". In: *Proceedings of the Third Workshop on Cryptography and Security in Computing Systems (CS2)*. Prague, Jan. 2016
- Thierno Barry, Damien Couroussé, Karine Heydeman, and Bruno Robisson. *Automated Combination of Tolerance and Control Flow Integrity Countermeasures against Multiple Fault Attacks*. 2017 European LLVM Developers Meeting. Sarrbrücken, Germany, Mar. 2017

Detection of attacks on IoT devices

- Sanaa Kerroumi, Damien Couroussé, Florian Pebay-Peyroula, Mohammed Benaoud, and Anca Molnos. *On the applicability of binary classification to detect memory access attacks in IoT*. C&ESAR. Rennes, Nov. 2018

Simulation of processor micro-architectures

- Fernando Akira Endo, Damien Couroussé, and Henri-Pierre Charles. "Pushing the Limits of Online Auto-tuning: Machine Code Optimization in Short-Running Kernels". In: *CoRR* abs/1707.04566 (2017)
- Fernando Endo, Damien Couroussé, and Henri-Pierre Charles. "Micro-architectural simulation of in-order and out-of-order ARM microprocessors with gem5". In: *Embedded Computer Systems: Architectures, Modeling, and Simulation (SAMOS XIV), 2014 International Conference on*. Greece, July 2014, pp. 266–273
- Fernando A. Endo, Damien Couroussé, and Henri-Pierre Charles. "Micro-architectural Simulation of Embedded Core Heterogeneity with Gem5 and McPAT". in: *Proceedings of the 2015 Workshop on Rapid Simulation and Performance Evaluation: Methods and Tools*. RAPIDO '15. Amsterdam, Holland: ACM, 2015, 7:1–7:6

Code optimization for performance

- Fernando Akira Endo, Damien Couroussé, and Henri-Pierre Charles. "Pushing the Limits of Online Auto-tuning: Machine Code Optimization in Short-Running Kernels". In: *CoRR* abs/1707.04566 (2017)
- Henri-Pierre Charles, Damien Couroussé, Victor Lomüller, Fernando A. Endo, and Rémy Gauguey. "deGoal a Tool to Embed Dynamic Code Generators into Applications". In: *Compiler Construction*. Ed. by Albert Cohen. Vol. 8409. Lecture Notes in Computer Science. Springer, 2014, pp. 107–112

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