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Specialty: Real-Time & Embedded Systems  
Model-Based System/Software Engineering  
**CV**

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## A Curriculum Vitae

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### A.1 Academic positions

sep. 2018 - *Professor* – ISAE-SUPAERO  
 oct. 2009 - *Associate professor* – ISAE-SUPAERO  
 sep. 2018

Head of third year curriculum in Computer Science, head of the Advanced Master in Embedded Systems. Teaching classes on real-time systems (RTOS, language, scheduling), model-based technologies (SysML, AADL), synchronous languages (SCADE) for the Supaero engineering degree, the Embedded Systems Advanced Master and the Aeronautical and Space Systems Master of Science. Research in model-based technologies, with a strong focus on AADL: code generation, application of formal methods for safety-critical systems.

oct. 2009 - *Associate Professor* – TELECOM PARISTECH  
 oct. 2005

Taught classes on real-time systems, synchronous languages (Lustre, Esterel) and software engineering for the Telecom ParisTech engineering curriculum, and the Master of Science SAR, with Université Pierre et Marie Curie. Research activities on distributed systems, real-time systems, use of formal methods in the context of distributed systems.

**Keywords:** *Model-Based System/Software Engineering, AADL, Distributed, Real-Time, Embedded Systems, Software Engineering, Modeling, formal verification, proof of programs.*

### A.2 Diploma

2017 *“Habilitation à Diriger des Recherches” – INP Toulouse*

Summary of my research activities to become full professor.  
 Topic of the dissertation: *“Architecture in the Service of Real-Time Middleware – Contributions to Architecture Description Languages”*.

2002 - 2005 *PhD in Computer Science – Telecom ParisTech*

PhD thesis performed in the “Computer and Network” team of the LTCI with Telecom ParisTech. Graduated with honors.  
 Topic of the dissertation: *“Architecture and services of real-time middleware”* under the supervision of L. Pautet (Telecom ParisTech) and F. Kordon (LIP6/SRC).  
 Available at <https://www.theses.fr/2005ENST0034>

2001 - 2002 *MSc in Distributed Systems – Université Pierre et Marie Curie*

Classes on distributed systems, concurrency, covering both practical and theoretical aspects.  
 Master Thesis dissertation on *“MOMA, Message Oriented Middleware for Ada”* under the supervision of L. Pautet (Telecom ParisTech) and F. Kordon (LIP6/SRC).

1999 - 2002 *Telecom ParisTech Engineering Degree*

Classes on computer science, networked systems, signal processing

## B Teaching activities

I am currently Professor with ISAE-Supaero, qualified as “Maître de Conférences” in the Computer Science section or CNU27 in 2006. My academic career led me to two institutions: first as associate professor with Telecom ParisTech starting in 2005, then with ISAE-Supaero since 2009.

*Note: The following list elements starting from 2009 onwards. The detailed list of classes and topics is available on request.*

**Aims** As a professor, my mission consists in training engineers for the safety-critical domain. My teaching activities cover multiple aspects of critical systems engineering: languages, methods, tools; both theoretical and practical.

**Programs supervision** Since 2009, I teach courses on real-time systems embedded within ISAE Engineers and Master’s Programs. I am the Head for ISAE of the specialized master “ Embedded Systems ” and of the last year CS program of the ISAE-Supaero Engineering degree.

Each program trains engineers for the aeronautics domain at large, with a strong focus on safety critical systems. I participate in the selection of professors from both academia and industry, and the definition of the classes.

**Classes taught** I teach numerous classes on embedded systems: real-time systems (RTOS and scheduling), Architecture design using AADL, real-time languages (Ada, RTSJ), distributed systems; along with projects mentoring. Classes are taught either in French or in English to foreign students.

The global volume of face-to-face with students exceeds 200 hours per academic year.

**Teaching Chair** Since November 2015, I am the Head of the Thales teaching chair on “Architecture and engineering of embedded SystEms” or ARISE. This chair aims at creating an expert track for our engineering students through the creation of advanced training classes, seminars and dedicated projects.

## C Research activities

As a member of the ISAE-Recherche laboratory, I’m involved in research on model-based techniques in the context of safety-critical systems. Since 2016, I am leading the IpSC research group. IpSC focuses on model-based engineering, code generation, application of formal methods and simulation techniques.

*Keywords: AADL, SysML, model-based system/software engineering, safety critical systems, formal verification, Ada/SPARK, RTOS, ARINC653*

### C.1 Summary of research activities

My research focuses on “*Architecture of Embedded Systems*” at large: real-time, embedded, cyber-physical or safety-critical. The long term objective is to define 1) unambiguous description mechanisms combined with guided methodology for 2) the analysis and 3) the synthesis of complex systems. These topics are pushed forward through:

**Architecture Description Languages – AADL** I am core member of the SAE AS2-C committee working on AADL since 2006. The AADL language is a concise and precise language defined to describe and analyze complex systems. Our contributions aim at transitioning AADL models to executable systems, either through model checking or code generation.

Since 2006, I contribute to the definition of AADLv2 [3] and subsequent revisions, the Data Modeling, Code Generation and ARINC653 annex documents [1, 2]; and the Ocarina AADL toolchain.

**Model processing tools – Ocarina** My research activities around AADL are validated by the Ocarina toolchain, a model transformation suite developed since 2004. As part of projects and PhD mentoring, we developed transformation towards Petri nets, scheduling analysis tools but also code generation towards high-integrity runtimes.

These contributions have been deployed in various R&D projects with academic and industrial partners: H2020 ESROCOS (with GMV, Airbus Defence and Space, DLR); TASTE (with the European Space Agency, Ellidiss); Flex-eWare (with Thales) or IRT Saint-Exupery.

**Middleware for high-integrity systems – PolyORB-HI** These highly configurable middleware are built on the “schizophrenic” middleware paradigm, enforcing a strong separation of concerns in middleware constructs, and aligned with requirements for high-integrity systems. PolyORB-HI is combined with code generated from AADL models to target various real-time platforms: Ada and SPARK2014; C RTOS (POSIX, RTEMS, Xenomai, FreeRTOS) or safety-critical OS (VxWorks653, DDC-I or XtratuM).

**Summary of contributions** Through the careful combination of AADL and code generation, supported by Ocarina and PolyORB-HI, we demonstrated how to reduce the complexity of the infrastructure code to support complex systems. This allows for better analyzability of systems through WCET analysis, proof of programs, while preserving performance and memory footprint.

These contributions have been published as Open Source software, and through academic publications.

## C.2 Scientific activities

### Standardization committee

2006 – *Member of SAE AS2-C on the Architecture Analysis and Design Language*

Standardization committee work, 4 meetings/year. Redaction of elements of the standard and promotion of AADL through books [22, 23] and tutorials (ESWeek, MODELS, HILT, ...)

### Organization of conferences and workshops

- IEEE International Symposium on Rapid System Prototyping (IEEE RSP), General Chair (2009), Program Chair (2008, 2010, 2012), Publicity Chair (2004-), member of the Steering Committee (2007-)
- Architecture Centric Virtual Integration Workshop, Organizer, 2016
- French Summer School on Real-Time systems: organizing team 2009 (Paris) and 2013 (Toulouse), steering committee (2009-)
- Dagstuhl Seminar #12272 “Architecture-Driven Semantic Analysis of Embedded Systems” with Peter Feiler (CMU/SEI) and Oleg Sokolsky (U. Penn.) [6]
- UML&AADL conference 2012, PC Chair
- Reliable Software Technologies 2009, Tutorial Chair

### Program committees

- Architecture Centric Virtual Integration Workshop (ACVI), 2014-2016

- International Conference on Software and Systems Engineering and their Applications (ICSSEA), 2011-2013
- International Workshop on Embedded Data-Centric Systems (EDACS), 2009
- Reliable Software Technologies, 2008-2018
- IEEE International Symposium on Object and component-oriented Real-time distributed Computing (IEEE ISORC), 2006-2008
- UML&AADL conference, 2010-2011
- UML&Formal Methods, 2011-2012
- Brazilian Conference on Critical Embedded Systems, 2011-2013
- International Workshop on Analytical Virtual Integration of Cyber-Physical Systems (AVICPS), part of RTSS, 2011-2014
- International Conference on Embedded Software (EMSOFT), 2013
- International Conference on Real-Time Networks and Systems (RTNS), 2013-2017
- Conférence francophone sur l'Architecture Logicielle (CAL), 2014-2016
- International Workshop on Model-Based Architecting and Construction of Embedded Systems (ACES-MB), part of Models, 2013
- EWiLi, Embedded Operating Systems Workshop, part of ESWeek, 2014-2017
- CRTS, Workshop on Compositional Theory and Technology for Real-Time Embedded Systems, part of RTSS, 2017
- FTSCS, International Workshop on Formal Techniques for Safety-Critical Systems, part of IFCEM, 2016, 2018

### Journals

- Editor (2012) with Oleg Sokolsky of a special issue of “Science of Computer Programming” (Elsevier) as a follow-up of the Dagstuhl Seminar #12272 [20]
- Editor (2009) with Kenneth Kent of a special issue of “Software Practice and Experience” (Elsevier), best papers of Rapid System Prototyping 2009, [21]
- Reviewer for ACM TECS, IEEE DS Online, Springer DAEM, Elsevier SCP, Wiley SPE, Springer SoSym

### C.3 Research projects

2008 – TASTE

TASTE provides a set of code generation facilities for the space domain. It is lead by the European Space Agency. We provide support for Ocarina and PolyORB-HI to ESA and its partners. [68, 29]

2016 - 2018 H2020 ESROCOS

ESROCOS aims at transitioning TASTE for safe robotics applications. We will study qualification of the Ocarina toolchain and the PolyORB-HI middleware.

2016 - 2017 IRT MOISE

MOISE addresses systems engineering shortcomings in extended company settings. We study coupling between architectural models and safety analysis.

2014 - 2016 INTEGRATING MODEL-BASED ANALYSIS TO SUPPORT VERIFIABLE SYSTEM COMPOSITION

This project studied AADL support for code generation for ARINC653 environments, safety analysis. This project has been done in collaboration with CMU/SEI.

2015 - 2016 IRT INGEQUIP

INGEQUIP explored topics in equipment engineering. We focused on software/hardware co-design support using AADL. [40]

2007 - 2009 ANR FLEX-EWARE

Flex-eWare aimed at leveraging component-based approaches for the engineering of embedded systems. We defined the foundations of code generation targetting the C language and RT-Linux. [82, 78].

2004 - 2007 FP6-IST ASSERT

ASSERT defined a process for the construction of space applications, leveraging code generation strategies from AADL models. This project is the root of the Ocarina project. [87, 88, 90, 91, 92, 94].

## C.4 Open Source Software

All my collaborations are gathered in two Open Source software:

2004 – *Ocarina – PolyORB-HI*  
<http://www.openaadl.org>

Ocarina is an integrated toolchain for AADL. I am leading the project, with partners from ESA, ENIS and the SEI. Combined with the PolyORB-HI middleware, Ocarina provides support to analyze (schedulability analysis, formal methods) and then generate critical systems. Part of this work led to the definition of AADL annex documents. This project has 200KSLOCs, it has been used in multiple R&D projects at ESA, and by partners from both industry and academia. We are transitioning it towards industry as part of the TASTE and ESROCOS projects, improving code quality and adherence to qualification standards.

2002 – 2007 *PolyORB*  
<http://www.adacore.com>

PolyORB is a “schizophrenic” middleware, a generic framework to support multiple standards for distributed systems (CORBA, DSA, MOM, ...). I contributed to this project as part of my PhD work, and my early career.

This software is now a fully supported product by AdaCore, and used by customers like Euro-control and Airbus Defence and Space.

## C.5 Alumni

### PhD students

- Patrick LESERF, 10/2013 - 5/2017, *Optimization of Embedded Systems Architectures in a Model-Based Setting.*, co-advisor with P. de Saqui-Sannes (ISAE).  
**Publications:** [28, 43, 47]
- Guillaume BRAU, 3/2013 - 3/2017, *Architecture Analysis Codesign through Model-Driven Engineering*, co-advisor with N. Navet (Université du Luxembourg).  
**Publications:** [46, 50, 53].
- Gilles LASNIER, 10/2008 - 8/2012, *Integrating Safety and Security in Model-Based Workflows, Towards Verification and Code Generation.*, co-advisor with L. Pautet (Telecom ParisTech/LTCI).  
**Publications:** [64, 66, 74]
- Olivier GILLES, 3/2007 - 4/2010, *Integrating the Target Platform in the Design of Safety-Critical Embedded Systems in a Model-Based Approach.*  
**Publications:** [7, 8, 10, 69, 71, 72, 79, 80]
- Xavier RENAULT, 10/2006 - 12/2009, *Integration of Formal and Semi-formal Models to Implement Distributed Real-time Embedded Systems.*, co-advisor with F. Kordon (LIP6/MoVe).  
**Publications:** [75, 76, 78, 82].

- Bechir ZALILA, 10/2005 - 11/2008, *Configuration and Deployment of Distributed Real-Time Embedded Systems using an ADL.*, co-advisor with L. Pautet (Telecom ParisTech/LTCI).  
**Publications:** [11, 12, 74, 83, 84, 85, 86, 88, 90, 91, 92, 94]

### Post-docs

- Tatiana PROSVIRNOVA, 1/2016 - 6/2017, “*Coupling of Error Propagation Models and Model-Based Systems Engineering.*”, as part of the IRT MOISE project.
- Bassem OUNI, 3/2015 - 7/2016, “*AADL-based hardware/software codesign workflow.*”, as part of the IRT INGEQUIP project. [40]
- Vincent GAUDEL, 10/2014 - 12/2015, “*Exhaustive simulation of AADL models*”, as part of the TASTE project.

## D Publications

### D.1 Standards

- [1] SAE AS2-C. SAE Architecture Analysis and Design Language (AADL) Annex Volume 1, Revision A. Standard AS5506/1A, SAE International, 2015.
- [2] SAE AS2-C. SAE Architecture Analysis and Design Language (AADL) Annex Volume 2. Standard AS5506/2, SAE International, 2011.
- [3] SAE AS2-C. Architecture Analysis & Design Language v2.0. Standard AS5506A, SAE International, January 2009.

### D.2 Journals

- [4] Guillaume Brau, Jérôme Hugues, and Nicolas Navet. Towards the systematic analysis of non-functional properties in model-based engineering for real-time embedded systems. *Elsevier Science of Computer Programming*, 156:1–20, 2018.
- [5] Wafa Gabsi, Bechir Zalila, and Jérôme Hugues. A development process for the design, implementation and code generation of fault tolerant reconfigurable real time systems. *International Journal of Autonomous and Adaptive Communications Systems (IJAACS)*, 9(3/4):269–287, 2016.
- [6] Peter Feiler, Jérôme Hugues, and Oleg Sokolsky. Architecture-Driven Semantic Analysis of Embedded Systems (Dagstuhl Seminar 12272). *Dagstuhl Reports*, 2(7):30–55, 2012.
- [7] Olivier Gilles and Jérôme Hugues. A MDE-based optimisation process for Real-Time systems: Optimizing systems at the architecture-level using the real DSL and library of transformation and heuristics. *International Journal of Computer Systems Science & Engineering*, 26(6), November 2011.
- [8] Julien Delange, Olivier Gilles, Jérôme Hugues, and Laurent Pautet. Model-Based Engineering for the Development of Partitioned Architectures. *SAE International Journal of Aerospace*, 3(1):79–86, December 2010.
- [9] Jorgen Hansson, Bruce Lewis, Jérôme Hugues, Lutz Wrage, Peter Feiler, and John Morley. Model-Based Verification of Security and Non-Functional Behavior using AADL. *IEEE Security & Privacy*, 8(1):43–49, January 2010.
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- [13] Jose A. Pulido, Juan Antonio de la Puente, Jérôme Hugues, Matteo Bordin, and Tullio Vardanega. Ada 2005 code patterns for metamodel-based code generation. *ACM SIGAda Ada Letters*, XXVII(2):53–58, August 2007.
- [14] Bechir Zalila, Jérôme Hugues, and Laurent Pautet. An Improved IDL Compiler for Optimizing CORBA Applications. *ACM SIGAda Ada Letters*, XXVI(3):21–27, December 2006.

### D.3 Journals, national

- [15] Jérôme Hugues and Pierre Siron. Ingénierie dirigée par les modèles pour la simulation, le cas de PRISE. *Génie Logiciel*, (109):pp. 38–42, June 2014.
- [16] Janette Cardoso, Jean-Charles Chaudemar, Alexandre Hamez, Jérôme Hugues, and Pierre Siron. Prise : une plate-forme de simulation distribuée pour l’ingénierie des systèmes embarqués. *Génie Logiciel*, (108):pp. 29–34, March 2014.
- [17] Guillaume Rivier, Stéphanie Lizy-Destrez, and Jérôme Hugues. Enseignement de l’ingénierie système : retour sur la conception d’un senseur stellaire pour ESEO et ESMO. *Génie Logiciel – Magazine de l’ingénierie du logiciel et des systèmes*, 100:50–54, June 2012.
- [18] Xavier Renault and Jérôme Hugues. Définition d’une famille de patrons de transformation de modèle pour l’analyse de modèles AADL. *Génie Logiciel – Magazine de l’ingénierie du logiciel et des systèmes*, 93:11–15, June 2010.
- [19] Etienne Borde, Frédéric Gilliers, Grégory Haik, Jérôme Hugues, and Laurent Pautet. MyCCMHI : un framework à composants mettant en oeuvre une approche d’ingénierie dirigée par les modèles. *Génie Logiciel – Magazine de l’ingénierie du logiciel et des systèmes*, 90:6–12, September 2009.

### D.4 Special Issues, Editor

- [20] Jérôme Hugues and Oleg Sokolsky. Preface to the special issue: Architecture-driven semantic analysis of embedded systems. *Sci. Comput. Program.*, 106:1–2, 2015.
- [21] Kenneth B. Kent and Jérôme Hugues. Editorial to the Special Issue of Rapid System Prototyping’10. *Software: Practice and Experience*, 42(7):779–779, 2012.

### D.5 Book, editor

- [22] Fabrice Kordon, Jérôme Hugues, Agusti Canals, and Alain Dohet. *Embedded Systems: Analysis and Modeling with SysML, UML and AADL*. Electronic Engineering Series. Wiley-ISTE, April 2013.
- [23] Fabrice Kordon, Jérôme Hugues, Agusti Canals, and Alain Dohet. *Modélisation et analyse de systèmes embarqués*. Collection SEE. Hermes Sciences, Paris, France, April 2013.



## D.6 Books

- [24] Grolleau Emmanuel, Hugues Jérôme, Ouhammou Yassine, and Bauer Henri. *Introduction aux systèmes embarqués temps réel : Conception et mise en oeuvre*. Sciences Sup. Dunod, Paris, 2018.
- [25] Francis Cottet, Emmanuel Grolleau, Sébastien Gérard, Jérôme Hugues, Yassine Ouhamou, and Sarah Tucci. *Systèmes temps réel embarqués : spécification, conception, implémentation et validation temporelle*. Technique et Ingénierie, Dunod/L’Usine Nouvelle. Dunod, Paris, 2014. 2ème édition.
- [26] John W. McCornick, Frank Singhoff, and Jérôme Hugues. *Building Parallel, Embedded, and Real-Time Applications with Ada*. Number 9780521197168 in ISBN. Cambridge University Press, April 2011.

## D.7 Book chapters

- [27] Jérôme Hugues and Julien Delange. Model-based design and automated validation of arinc653 architectures using the aadl. In Shin Nakajima, Jean-Pierre Talpin, Masumi Toyoshima, and Huafeng Yu, editors, *Cyber-Physical System Design from an Architecture Analysis Viewpoint : Communications of NII Shonan Meetings*, pages pp. 33–52. Springer, 2017.
- [28] Patrick Leserf, Pierre Saqui-Sannes, Jérôme Hugues, and Khaled Chaaban. *Model-Driven Engineering and Software Development: Third International Conference, MODELSWARD 2015, Angers, France, February 9-11, 2015, Revised Selected Papers*, chapter Architecture Optimization with SysML Modeling: A Case Study Using Variability, pages 311–327. Springer International Publishing, Cham, 2015.
- [29] Maxime Perrotin, Julien Delange, and Jérôme Hugues. *Distributed Systems: Design and Algorithms*, chapter Concrete aerospace systems. Number 978-1-84821-250-3 in ISBN. Wiley-ISTE, June 2011.
- [30] Jérôme Hugues, Laurent Pautet, and Fabrice Kordon. *Méthodes Formelles pour les Systèmes Répartis et Coopératifs*, chapter Construction d’un intergiciel vérifié. Number 2-7462-1447-4 in ISBN. October 2006.

## D.8 Conferences and workshop

- [31] Wang Zhe, Jerome Hugues, Jean-Charles Chaudemar, and Thierry LeSergent. An integrated approach to model based engineering with sysml, aadl and face. In *Proceedings of Aerospace Systems and Technology Conference 2018 (ASTC’18)*. SAE International, 10 2018.
- [32] Hana Mkaouar, Bechir Zalila, Jérôme Hugues, and Mohamed Jmaiel. An ocarina extension for AADL formal semantics generation. In *Proceedings of the 33rd Annual ACM Symposium on Applied Computing, SAC 2018, Pau, France, April 09-13, 2018*, pages 1402–1409, 2018.
- [33] Christophe Honvault, Jérôme Hugues, and Claire Pagetti. Model-Based Design, Analysis and Synthesis for TSP Multi-Core Space systems. In *Proceedings of 9th European Congress Embedded Real Time Software and Systems ERTSS 2018, Toulouse, France, Jan 31-Feb 2 2018*, 2018.
- [34] Jérôme Hugues, Jean-Marie Gauthier, and Raphaël Faudou. Integrating AADL and FMI to extend virtual integration capability. In *Proceedings of 9th European Congress Embedded Real Time Software and Systems ERTSS 2018, Toulouse, France, Jan 31-Feb 2 2018*, 2018.

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- [43] Patrick Leserf, Pierre de Saqui-Sannes, and Jérôme Hugues. Multi Domain optimization with SysML modeling. In *20th IEEE International Conference on Emerging Technologies and Factory Automation*, Luxembourg, September 2015.
- [44] Frank Singhoff, Alain Plantec, Stéphane Rubini, Hai-Nam Tran, Vincent Gaudel, Jalil Boukhobza, Laurent Lemarchand, Shuai Li, Etienne Borde, Laurent Pautet, Jérôme Hugues, Pierre Dissaux, Jérôme Legrand, Christian Fotsing, and Djika Blandine. Teaching Real-Time Scheduling Analysis with Cheddar. In *Ecole d'été temps réel, ETR 2015*, Rennes, France, August 2015.
- [45] Hana Mkaouar, Bechir Zalila, Jérôme Hugues, and Mohamed Jmaiel. From AADL model to LNT specification. In *Reliable Software Technologies - Ada-Europe 2015 - 20th Ada-Europe International Conference on Reliable Software Technologies, Madrid Spain, June 22-26, 2015, Proceedings*, pages 146–161, June 2015.
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- [47] Patrick Leserf, Pierre de Saqui-Sannes, Jérôme Hugues, and Khaled Chaaban. Sysml modeling for embedded systems design optimization: A case study. In *MODELSWARD 2015*, Angers, FR, February 2015.

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