



Activity Report 2016

Team POSET

Modèles pour la Programmation Structurée de l'Espace et du Temps

Inria teams are typically groups of researchers working on the definition of a common project, and objectives, with the goal to arrive at the creation of a project-team. Such project-teams may include other partners (universities or research institutions).

RESEARCH CENTER
Bordeaux - Sud-Ouest

THEME
Embedded and Real-time Systems

Table of contents

1. Members	2
2. Overall Objectives	2
3. Research Program	2
3.1.1. Models	3
3.1.2. Languages	3
3.1.3. Systems	3
4. Application Domains	3
4.1.1. Temporal media analysis and creation	3
4.1.2. Interactive and distributed interfaces	4
5. Highlights of the Year	4
6. New Software and Platforms	4
7. New Results	4
7.1. Alpha release of the T -calculus	4
7.2. A new collaboration with Bernard Serpette	4
8. Bilateral Contracts and Grants with Industry	5
9. Partnerships and Cooperations	5
9.1. Regional Initiatives	5
9.1.1. SCRIME	5
9.1.2. Idex Bordeaux	5
9.2. International Initiatives	5
9.3. International Research Visitors	5
10. Dissemination	5
10.1. Promoting Scientific Activities	5
10.1.1. Scientific Events Organisation	5
10.1.2. Scientific Events Selection	5
10.1.2.1. Chair of Conference Program Committees	5
10.1.2.2. Member of the Conference Program Committees	5
10.1.2.3. Reviewer	5
10.1.3. Journal	6
10.1.3.1. Member of the editorial boards	6
10.1.3.2. Reviewer - Reviewing activities	6
10.1.4. Leadership within the Scientific Community	6
10.1.5. Research Administration	6
10.2. Teaching - Supervision - Juries	6
10.2.1. Teaching	6
10.2.2. Supervision	7
10.2.3. Juries	7
10.3. Popularization	7
11. Bibliography	7

Team POSET

Creation of the Team: 2015 January 01, end of the Team: 2016 December 31

Keywords:

Computer Science and Digital Science:

- 1.2.5. - Internet of things
- 1.3. - Distributed Systems
- 1.5.2. - Communicating systems
- 2.1. - Programming Languages
 - 2.1.1. - Semantics of programming languages
 - 2.1.10. - Domain-specific languages
- 2.2.1. - Static analysis
- 2.3.3. - Real-time systems
- 2.5. - Software engineering
 - 2.5.1. - Software Architecture & Design
 - 2.5.2. - Component-based Design
- 5.1.1. - Engineering of interactive systems
- 5.1.7. - Multimodal interfaces
- 5.2. - Data visualization
- 5.4.4. - 3D and spatio-temporal reconstruction
- 5.5.1. - Geometrical modeling
- 5.5.4. - Animation
- 5.7.2. - Music
- 5.7.4. - Analysis
- 5.7.5. - Synthesis
- 6.1.3. - Discrete Modeling (multi-agent, people centered)
- 7.4. - Logic in Computer Science
- 7.5. - Geometry, Topology
- 7.6. - Computer Algebra
- 7.14. - Game Theory

Other Research Topics and Application Domains:

- 6.1.1. - Software engineering
- 6.4. - Internet of things
- 6.6. - Embedded systems
- 9.1.1. - E-learning, MOOC
- 9.2.1. - Music, sound
- 9.4.1. - Computer science
- 9.4.2. - Mathematics
- 9.5.10. - Digital humanities
- 9.6. - Reproducibility
- 9.7. - Knowledge dissemination
 - 9.7.1. - Open access

1. Members

Faculty Members

David Janin [Team leader, Bordeaux INP, Associate Professor, HDR]
Myriam Desainte-Catherine [Bordeaux INP, Professor, HDR]
Anne Dicky [Univ. Bordeaux, Associate Professor]
Sylvain Salvati [Univ. Lille I, Professor, HDR]

Engineer

Jaime Eduardo Arias Almeida [Inria]

PhD Students

Simon Archipoff [Univ. Bordeaux]
Jean-Michaël Celerier [CIFFRE, Blue Yeti]
Etienne Dubourg [Univ. Bordeaux, until Aug 2016]
Pauline Mouawad [Univ. Bordeaux]

Administrative Assistants

Sabine Delarboulas Cusin [INRA]
Anne-Laure Gautier [Inria]

Other

Edwin Buger [Intermittent du spectacle]

2. Overall Objectives

2.1. Overall Objectives

How to capture, analyse, mix, combine or transform temporal media streams as varied as sounds, animations, melodies, videos, control gestures? Modern technologies make it possible to produce complex multimodal artistic computerized systems, but require the support of specially trained technicians to turn artistic intentions into technical realizations. Since modern system designers are more often artists than software developers, we aim at developing system design tools directly accessible to the artists.

In this project, we try to offer simple, uniform formalisms and tools for the representation and the manipulation of temporal media streams. This is achieved by developing new models for the hierarchical and modular design of interactive timed systems, and applying these models to the realization of artistic interactive applications. Our concrete experiments, guided by formal models challenged by experimental needs, ensure the adequacy and the robustness of our proposals.

The resulting software methodologies and design tools for the creation of interactive pieces of art should be user-friendly and robust. In particular, the resulting technical constraints should no longer hide the inadequacy of ad hoc and immature interfaces, but address critical issues such as the coherence and compatibility of design objectives .

Remark: the PoSET Inria team was created on the first of January 2015 in the Inria research center of Bordeaux with members of the UMR CNRS LaBRI. The project has eventually been ended of the 31th of December 2016.

3. Research Program

3.1. Research Program

Our research programs is structured into three complementary research axis : models, languages and systems, allowing us to develop our multi-disciplinary approach while validating each progress in the related specific fields of computer science ranging among computer music, multi-modal system design, reactive and real-time programming, typed functional programming, formal languages, graph representation theory, applied algebra, logic in computer science, etc.

3.1.1. Models

Inverse semigroup theory has recently been shown [13], [7], [12] [20] to unify most string-based, tree-based or even graph-based modeling approaches. It thus provides a consistent and robust mathematical framework to model the sequential, parallel and reactive aspects of temporal media. Developing the mathematical foundations of our proposal amounts to:

- studying the combinatorial and algorithmic properties of the emerging algebra-based model of structured temporal media,
- developing formal techniques and tools for expressing and verifying properties of temporal media programs especially with a view towards capturing temporal media programming by constraint satisfaction approaches,
- deriving from the known generators of these models adequate sets of application-oriented modeling functions.

3.1.2. Languages

Functional programming is the key link between well-defined mathematical structures and their computerized realizations. Based on functional programming frameworks such as Haskell ¹, we are prototyping a Domain Specific Language (DSL) [10] [15] dedicated to the programming of interactive temporal media programming. In this research axis, we aim more specifically at

- designing a robust and modular software architecture that allows to reuse existing pieces of software as well as simply combining them together with new ones,
- defining and implementing a DSL for programming interactive multimedia systems via a simple algebra-based high-level and multi-scale control and combination layer,
- finding the right balance between generic views of temporal media when seen as abstract temporal frames and their specializations when representing concrete gestures, sound, audio, videos, animations, etc.

3.1.3. Systems

Multi-modal interactive systems gather various techniques to capture and analyze gestures, and to combine, transform and produce temporal media. Through regular experiments in collaboration with artists, we also aim at assessing, refining and extending the applicability of our proposal by:

- developing a robust and mathematically well-founded representation of systems and of their behaviors, both programmatic and visual,
- developing and evaluating the adequacy of the GUI induced by this representation when used by artists,
- relating the new models with more classical models of music formalisms and, beyond, other temporal media such as animations, videos, etc.

4. Application Domains

4.1. Application Domains

4.1.1. Temporal media analysis and creation

Our first application domain concerns temporal media analysis and creation. Of course, many existing tools allow to create, combine and transform temporal media such as sounds, music, videos, animations. Strictly speaking, we do not aim at offering new possibilities. However, with an approach based on modern development theory and software technologies, we shall offer more reliable tools, that enjoy much higher productivity and reusability. As an immediate application, the fruit of our research may increase the quality of the technological assistance provided by Art & Science studios such as the SCRIME ². In this view, we shall concentrate our application perspectives on temporal media analysis (e.g. structure inference algorithms and learning tools) and on temporal media combination and synthesis (e.g. tools for music composition).

¹See [31] for an historical presentation of the Haskell programming language.

²Studio de Création et de Recherche en Informatique et Musiques Expérimentales

4.1.2. Interactive and distributed interfaces

Our second application domain lays in the field of interaction. New technologies already used in artistic installations are connected and interactive. But there is still a whole world to be discovered and equipped with adequate technologies to design tomorrow's interactive and distributed pieces of digital arts. In this perspective, we shall concentrate on developing techniques for the capture and the on-the-fly analysis of input streams, together with techniques to combine them and turn them into new media types.

5. Highlights of the Year

5.1. Highlights of the Year

An α -version of the T-calculus [21] have been released ³.

It has been experimented in an Art & Science project ⁴ that have illustrated its expressiveness and simplicity for describing reactive music [19], [23]. This Art & Science project will be “on stage” in february 2017 via a “Duo solo for piano and computer”.

The software *i-score* have also been further experimented [24], [16] especially during the visit of Shlomo Dubnov (UCSD) in 2016.

6. New Software and Platforms

6.1. T-calculus

Sketched in [10], the *T-calculus* is a Domain Specific Language ⁵ to provide simple and robust high-level description mechanisms of reactive systems. It will offer a programmatic view of the tile modeling paradigm [3], [9]. Its definition has been refined a number of times (see e.g. [10], [8]). A prototype implementation of its reactive kernel has eventually been achieved in Haskell on top of the Euterpea libraries during the spring 2016 [15], [21], [19], [23]

7. New Results

7.1. Alpha release of the *T*-calculus

One of the main achievement of the PoSET project in 2016 is the alpha release of the *T*-calculus [15] that not only implements the tiled front-end programming interface that was proposed earlier [10], [8], but also an original mid-end programming interface for implementing interactive behavior and the related categorical combinators that allows for effectively running these high level constructs.

7.2. A new collaboration with Bernard Serpette

A new collaboration with Bernard Serpette also aim at developing a formal models for the T-calculus semantics [27], [25]. Though at its birth, such an approach eventually reveals rather deep connection with Matsikoudis and Lee works on causal functions semantics [33], opening new perspectives towards higher-order timed programming.

³see [the T-calculus url](#)

⁴see [the Interpolation project](#)

⁵See [30] for an early note by Hudak about the notion of Domain Specific Language, and see [29], [32] for application of this notion is computer music.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- PhD Grant CIFFRE, 2015-2018, for Jean-Michael Célérier, in partnership with **Blue Yeti** (Royan),

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. SCRIME

The **Studio de Création et de Recherche en Informatique et Musiques Expérimentales (SCRIME)** located on Bordeaux University Campus, is a *Groupement d'Intérêt Scientifique et Artistique (GIS&A)* gathering Université de Bordeaux, CNRS, Bordeaux INP, Ministère de la Culture et de la Communication, Ville de Bordeaux and Région Aquitaine. It is a privileged partner of the PoSET project. Most PoSET artistic projects are organized in cooperation with the SCRIME.

9.1.2. Idex Bordeaux

- 2 *Arts & Science* projects of Bordeaux eventually granted in 2016 by the Initiative of Excellence (Idex) of Bordeaux,

9.2. International Initiatives

9.2.1. Inria International Partners

9.2.1.1. Informal International Partners

In 2016, PoSET members had active collaboration with

- Shlomo Dubnov, UCSD, USA,
- Mark Lawson, Herriot-Watt University, Edimbourg, UK,
- Camillo Rueda, Universidad Javeriana, Cali, Colombia,

9.3. International Research Visitors

9.3.1. Visits of International Scientists

Shlomo Dubnov, Professor at UCSD (USA), was member of the PoSET project for nine months, thanks to an Bordeaux Idex fellowship in 2016.

10. Dissemination

10.1. Promoting Scientific Activities

10.1.1. Scientific Events Organisation

10.1.1.1. General Chair, Scientific Chair

- D. Janin, General Chair of **ACM Workshop on Functional Art, Music, Modeling and Design (FARM)**, Nara (Japan), associated with ICFP,

10.1.2. Scientific Events Selection

10.1.2.1. Chair of Conference Program Committees

- D. Janin, PC Chair of **Journées d'Informatique Musicale (JIM 2015)**, Albi (France),

10.1.2.2. Member of the Conference Program Committees

- M. Desainte-Catherine, PC member of **Journées d'Informatique Musicale (JIM 2015)**, Albi (France),

10.1.2.3. Reviewer

Members of the project are yearly reviewers for a number of international conferences including LICS, ICALP, STACS, MFCS, FST&TCS, in theoretical computer science, and ICMC, SMC, NIME, FARM, TENOR, JIM in computer music.

10.1.3. Journal

10.1.3.1. Member of the editorial boards

- S. Salvati is editor of the **Journal of Logic Language and Information (JoLLI)**; since the end of 2015, he has been promoted as Editor in Chief,
- M. Desainte-Catherine is editor of the **Revue francophone d'informatique musicale (RFIM)**.

10.1.3.2. Reviewer - Reviewing activities

Members of the project are regular reviewers for a number of international journal including **ACM Computers In Entertainment (CIE)**, **Journal of New Music Research (JNMR)**, **Journal of Logic Language and Information (JoLLI)**, **Revue francophone d'informatique musicale (RFIM)**, **Discrete Mathematics & Theoretical Computer Science (DMTCS)**, **International Journal of Foundations of Computer Science (IJFCS)**, **Information & Computation (I&C)** ...

10.1.4. Leadership within the Scientific Community

- M. Desainte-Catherine is president of the **Association Française d'Informatique Musicale (AFIM)**
- S. Salvati is the secretary of the **Foundation for Logic Language and Information (FoLLI)**.

10.1.5. Research Administration

- M. Desainte-Catherine, directrice adjointe du LaBRI,
- M. Desainte-Catherine, directrice scientifique et administrative du SCRIME,
- M. Desainte-Catherine, responsable du thème SI de l'équipe image et son du LaBRI,
- D. Janin, membre commission recherche Bordeaux INP/ENSEIRB-MATMECA.

10.2. Teaching - Supervision - Juries

10.2.1. Teaching

Licence: Myriam Desainte-Catherine, *Programmation fonctionnelle*, 44 h, L3, Software Engineering department, Bordeaux INP, France,

Licence: Myriam Desainte-Catherine, *Projet d'algorithmique et de programmation*, 25 h, L3, Software Engineering department, Bordeaux INP, France,

Licence: Anne Dicky, *Algorithmique des graphes*, 30 h, L3, Computer Science Departement, Paris VI University, Vietnam,

Licence: Anne Dicky, *Probabilités et combinatoire*, 75 h, L3, Computer Science Departement, Bordeaux University, France,

Licence: Anne Dicky, *Algorithmique et structures de données*, 50h, L2, Computer Science Departement, Bordeaux University, France,

Licence: Anne Dicky, *Fondamentaux pour les mathématiques et l'informatique*, 35 h, L1, Computer Science Departement, Bordeaux University, France,

Master: Sylvain Salvati, *Logique*, 12h, M1, Computer Science Departement, Bordeaux University, France,

Licence: David Janin, *Projet d'algorithmique et de programmation*, 25 h, L3, Software Engineering department, Bordeaux INP, France,

Licence: Sylvain Salvati, *Analyse syntaxique et projet de programmation 3*, 37,5 h, niveau L3, Computer Science Departement, Bordeaux University, France,

Master: Myriam Desainte-Catherine, *Compilation*, 14 h, M1, Software Engineering department, Bordeaux INP, France,

Master: Myriam Desainte-Catherine, *Projet de Génie Logiciel*, 25 h, M1, Software Engineering department, Bordeaux INP, France,

Master: Myriam Desainte-Catherine, *Informatique musicale contrôle et composition*, 25 h, M2, Software Engineering department, Bordeaux INP, France,

Master: Anne Dicky, *Recherche operationelle*, 70 h, M1, Computer Science Departement, Bordeaux University, France,

Master: David Janin, *Projet de Génie Logiciel*, 25 h, M1, Software Engineering department, Bordeaux INP, France,

Master: David Janin, *Compilation*, 20 h, M1, Network and System Engineering department (RSI), Bordeaux INP, France,

Master: David Janin, *Tutorat*, 15 h, M1, M2, Network and System Engineering department (RSI), Bordeaux INP, France,

Doctorat: Sylvain Salvati, *Initiation à CoQ*, 12 h, Ecole Doctorale Mathématique et Informatique, Bordeaux University, France.

10.2.2. Supervision

PhD : Etienne Dubourg, “Contribution à la théorie des langages de tuiles”, defended in July 2016, supervised by D. Janin

PhD in progress : Pauline Mouawad, “Analyse et modélisation de l’émotion musicale”, started in september 2012, supervised by M. Desainte-Catherine,

PhD in progress : Jean-Michaël Célérier, “Outils d’écriture spatiale pour les partitions interactives”, started in january 2015, supervised by M. Desainte-Catherine,

PhD in progress : Simon Archipoff, “Modélisation et programmation tuilée réactive”, started in september 2015, supervised by D. Janin,

10.2.3. Juries

- D. Janin, member of the PhD jury of Clément Poncelet, “Model-Based Testing Real-Time and Interactive Music Systems”, Université Paris VI / IRCAM, November 2016,

10.3. Popularization

The development of the T-calculus has eventually led us to a piano & computer performance that is going to be performed on stage in February 2017 with the pianist Edwin Bugger, associate member of the PoSET project.

11. Bibliography

Major publications by the team in recent years

- [1] A. ALLOMBERT, M. DESAINTE-CATHERINE. *Interactive scores : A model for specifying temporal relations between interactive and static events*, in "Journal of New Music Research (JNMR)", 2005, vol. 34, n^o 4, pp. 361–374
- [2] J. ARIAS, M. DESAINTE-CATHERINE, C. RUEDA. *Modelling Data Processing for Interactive Scores Using Coloured Petri Nets*, in "14th International Conference on Application of Concurrency to System Design", Tunis, Tunisia, June 2014 [DOI : 10.1109/ACSD.2014.23], <https://hal.archives-ouvertes.fr/hal-01095176>
- [3] F. BERTHAUT, D. JANIN, B. MARTIN. *Advanced synchronization of audio or symbolic musical patterns: an algebraic approach*, in "International Journal of Semantic Computing", 2012, vol. 6, n^o 4, pp. 409–427 [DOI : 10.1142/S1793351X12400132], <http://hal.archives-ouvertes.fr/hal-00794196>

- [4] A. BLUMENSATH, D. JANIN. *A syntactic congruence for languages of birooted trees*, in "Semigroup Forum", 2014 [DOI : 10.1007/s00233-014-9677-x], <http://hal.archives-ouvertes.fr/hal-00947972>
- [5] A. CLAY, N. COUTURE, E. DECARSIN, M. DESAINTE-CATHERINE, P. VULLIARD, J. LARRALDE. *Movement to emotions to music: using whole body emotional expression as an interaction for electronic music generation*, in "In proceedings of the 12th conference on New Instruments for Musical Expression (NIME)", 2012
- [6] M. DESAINTE-CATHERINE, A. ALLOMBERT, G. ASSAYAG. *Towards a Hybrid Temporal Paradigm for Musical Composition and Performance: The Case of Musical Interpretation*, in "Computer Music Journal", 2013, vol. 37, n^o 2, pp. 61–72
- [7] A. DICKY, D. JANIN. *Two-way automata and regular languages of overlapping tiles*, in "Fundamenta Informaticae", 2015, vol. 142, pp. 1-33 [DOI : 10.3233/FI-2015-1280], <https://hal.archives-ouvertes.fr/hal-00717572>
- [8] P. HUDAK, D. JANIN. *Tiled Polymorphic Temporal Media*, in "Work. on Functional Art, Music, Modeling and Design (FARM)", ACM Press, 2014, pp. 49-60 [DOI : 10.1145/2633638.2633649], <http://hal.archives-ouvertes.fr/hal-00955113>
- [9] D. JANIN, F. BERTHAUT, M. DESAINTE-CATHERINE. *Multi-scale design of interactive music systems : the libTuiles experiment*, in "Sound and Music Comp. (SMC)", 2013, pp. 123 – 129, <http://hal.archives-ouvertes.fr/hal-00813313>
- [10] D. JANIN, F. BERTHAUT, M. DESAINTE-CATHERINE, Y. ORLAREY, S. SALVATI. *The T-Calculus : towards a structured programming of (musical) time and space*, in "Work. on Functional Art, Music, Modeling and Design (FARM)", ACM Press, 2013, pp. 23-34 [DOI : 10.1145/2505341.2505347], <http://hal.archives-ouvertes.fr/hal-00789189>
- [11] D. JANIN. *Towards a higher dimensional string theory for the modeling of computerized systems*, in "Int. Conf. on Current Trends in Theo. and Prac. of Comp. Science (SOFSEM)", LNCS, Springer, 2014, vol. 8327, pp. 7–20 [DOI : 10.1007/978-3-319-04298-5_2], <http://hal.archives-ouvertes.fr/hal-00879463>
- [12] D. JANIN. *Inverse monoids of higher-dimensional strings*, in "12th International Colloquium on Theoretical Aspects of Computing (ICTAC 2015)", Cali, Colombia, Lecture Notes in Computer Science, Springer, 2015, vol. 9399, <https://hal.archives-ouvertes.fr/hal-01165724>
- [13] D. JANIN. *On labeled birooted tree languages: algebras, automata and logic*, in "Journal of Information and Computation", 2015, vol. 243, pp. 222 - 248 [DOI : 10.1016/J.IC.2014.12.016], <https://hal.archives-ouvertes.fr/hal-00982538>

Publications of the year

Articles in International Peer-Reviewed Journals

- [14] J. ARIAS, J.-M. CELERIER, M. DESAINTE-CATHERINE. *Authoring and automatic verification of interactive multimedia scores*, in "Journal of New Music Research", November 2016, pp. 1 - 19 [DOI : 10.1080/09298215.2016.1248444], <https://hal.archives-ouvertes.fr/hal-01399925>

International Conferences with Proceedings

- [15] S. ARCHIPOFF, D. JANIN. *Structured reactive programming with polymorphic temporal tiles*, in "ACM International Workshop on Functional Art, Music, Modelling, and Design (FARM)", Nara, Japan, 2016 [DOI : 10.1145/2975980.2975984], <https://hal.archives-ouvertes.fr/hal-01350525>
- [16] J. ARIAS, M. DESAINTE-CATHERINE, S. DUBNOV. *Automatic Construction of Interactive Machine Improvisation Scenarios from Audio Recordings*, in "The Fourth International Workshop on Musical Metacreation (MUME 2016)", Paris, France, June 2016, <https://hal.archives-ouvertes.fr/hal-01336825>
- [17] J.-M. CELERIER, M. DESAINTE-CATHERINE, J.-M. COUTURIER. *Graphical Temporal Structured Programming for Interactive Music*, in "International Computer Music Conference", Utrecht, Netherlands, September 2016, <https://hal.inria.fr/hal-01364702>
- [18] J.-M. CELERIER, M. DESAINTE-CATHERINE, J.-M. COUTURIER. *Rethinking the audio workstation: tree-based sequencing with i-score and the LibAudioStream*, in "Sound and Music Computing Conference", Hamburg, Germany, August 2016, <https://hal.archives-ouvertes.fr/hal-01360797>
- [19] D. JANIN. *A robust algebraic framework for high-level music writing and programming*, in "Technologies for Music Notation and Representation (TENOR)", Cambridge, United Kingdom, May 2016, <https://hal.archives-ouvertes.fr/hal-01246584>
- [20] D. JANIN. *Walking automata in free inverse monoids*, in "42nd International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM)", Harrachov, Czech Republic, January 2016, <https://hal.archives-ouvertes.fr/hal-00738793>

National Conferences with Proceedings

- [21] S. ARCHIPOFF, J. ARIAS, E. BUGER, D. JANIN. *Interpolations : écriture de contraintes réactives pour improvisations pianistiques (démo)*, in "Journées d'Informatique Musicale (JIM)", Albi, France, March 2016, <https://hal.archives-ouvertes.fr/hal-01326559>
- [22] S. ARCHIPOFF, D. JANIN. *Pour un raffinement spatio-temporel tuilé*, in "JFLA 2016 : Vingt-septièmes Journées Francophones des Langages Applicatifs", Saint-Malo, France, January 2016, <https://hal.archives-ouvertes.fr/hal-01247424>
- [23] S. ARCHIPOFF, D. JANIN. *Vers une programmation réactive structurée*, in "Journées d'Informatique Musicale (JIM)", Albi, France, March 2016, <https://hal.archives-ouvertes.fr/hal-01326557>
- [24] J.-M. CELERIER, M. DESAINTE-CATHERINE, J.-M. COUTURIER. *Outils d'écriture spatiale pour les partitions interactives*, in "Journées d'informatique musicale 2016", Albi, France, Journées d'informatique musicale 2016, March 2016, pp. 82-92, <https://hal.archives-ouvertes.fr/hal-01300348>
- [25] B. P. SERPETTE, D. JANIN. *Causalité dans les calculs d'événements*, in "JFLA 2017 - Vingt-huitième Journées Francophones des Langages Applicatifs", Gourette, France, January 2017, <https://hal.inria.fr/hal-01403369>

Scientific Books (or Scientific Book chapters)

- [26] G. GAGNERÉ, R. RONFARD, M. DESAINTE-CATHERINE. *La simulation du travail théâtral et sa " notation " informatique*, in "La notation du travail théâtral : du manuscrit au numérique", M. MARTINEZ, S. PROUST (editors), Lansman, October 2016, <https://hal.inria.fr/hal-01389848>

Research Reports

- [27] D. JANIN, B. P. SERPETTE. *Timed Denotational Semantics for Causal Functions over Timed Streams*, LaBRI - Laboratoire Bordelais de Recherche en Informatique, November 2016, <https://hal.archives-ouvertes.fr/hal-01402209>

Other Publications

- [28] J.-M. CELERIER. *Techniques vidéo-ludiques pour logiciel auteur multimédia*, March 2016, Journée de l'École doctorale de mathématiques et informatique, Poster, <https://hal.archives-ouvertes.fr/hal-01300355>

References in notes

- [29] P. HUDAK. *The Haskell School of Music : From signals to Symphonies*, Yale University, Department of Computer Science, 2013
- [30] P. HUDAK. *Keynote Address - The Promise of Domain-Specific Languages*, in "Proceedings of the Conference on Domain-Specific Languages (DSL)", 1997
- [31] P. HUDAK, J. HUGUES, S. PEYTON JONES, P. WADLER. *A History of Haskell: Being Lazy With Class*, in "Third ACM SIGPLAN History of Programming Languages (HOPL)", ACM Press, 2007
- [32] P. HUDAK, D. QUICK, M. SANTOLUCITO, D. WINOGRAD-CORT. *Real-time Interactive Music in Haskell*, in "Work. on Functional Art, Music, Modeling and Design (FARM)", ACM, 2015, pp. 15–16
- [33] E. MATSIKOU DIS, E. A. LEE.. *The fixed-point theory of strictly causal functions*, in "Theor. Comp. Sci.", 2015, vol. 574, pp. 39-77