



RESEARCH CENTER
Nancy - Grand Est

FIELD

Activity Report 2016

Section Highlights of the Team

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ALICE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Geometry processing

Meshes composed of hexahedra (deformed cubes) are desirable for certain numerical simulations, they can improve both performances and precision. They are very difficult to generate. We developed in 2010 one of the first fully automatic algorithms that generates a "hex-dominant" hybrid mesh (top part of the image), with hexahedra and other elements (colored). This year, we made a quantum leap, and significantly reduced the number of non-hex elements (bottom part of the image). Our approach is based on an optimization of a direction field [11] and a global parameterization steered by the direction field [9].

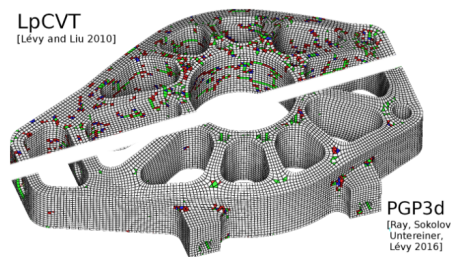


Figure 1. Improvements in hexahedral dominant remeshing.

5.1.2. Additive manufacturing

The advent of additive manufacturing enables the fabrication of shapes with unprecedented complexity, in particular embedding intricate micro-structures with details in the order of tens of microns. There is a strong interest in different fields for such structures, in medical science (prosthetics), mechanical engineering (strong but lightweight materials), art and design (aesthetics, material strength and flexibility). Unfortunately, we lack the software tools to model these structures efficiently. This year we made two significant advances in this area. We first proposed a novel methodology to create procedural micro-structures that exhibit good mechanical properties and can be fabricated [7]. As the definition of the micro-structure is procedural, they are not pre-computed. Instead their geometry is evaluated on the fly, slice after slice, during the additive manufacturing process. Yet, their elasticity can be progressively varied within the shape to align with geometric features. Our second contribution is a novel algorithm to synthesize intricate filigree patterns along a surface, from basic elements [5]. This is achieved by relaxing a strict geometric packing problem by to allow for partial overlaps between elements that preserve local geometric details. The shapes are optimized for strength during the synthesis.

BIGS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

BIGS team has organised a two-days workshop "Rencontres des équipes Inria travaillant sur le cancer" that took place Paris in March. 10 inria teams were present. The program is available on <https://team.inria.fr/bigs/workshopcancer/>.

CAMUS Team

5. Highlights of the Year

5.1. Highlights of the Year

Arthur Charguéraud, Inria Research Scientist, has joined the team in October 2016.

The first release of the speculative polyhedral loop parallelizer *Apollo*⁰ has been published under the BSD 3-Clause Open Source License.

5.1.1. Awards

BEST PAPERS AWARDS :

[13] **Euro-Par 2016**. J. M. MARTINEZ CAAMAÑO, W. WOLFF, P. CLAUSS.

⁰<http://apollo.gforge.inria.fr>

CAPSID Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

A figure from our article in the *Journal of Applied Crystallography* [19] was used to illustrate the front cover of the February issue of the journal.

CARAMBA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The Caramba project-team was created on January 1st, 2016!

In October 2016, Pierrick Gaudry and Emmanuel Thomé, together with colleagues from the University of Pennsylvania (USA), have performed a discrete logarithm computation of a 1024-bit trapdoored prime [18].

CARTE Team

5. Highlights of the Year

5.1. Highlights of the Year

The Marie Curie RISE project *Computing with Infinite Data* coordinated by Dieter Spreen (Siegen University), in which Mathieu Hoyrup is participating, has been accepted. It will start in April 2017.

COAST Project-Team (section vide)

LARSEN Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- “Prix La Recherche 2016” (mention “sciences de l’information”), to Jean-Baptiste Mouret and his co-authors (Antoine Cully, Jeff Clune, Danesh Tarapore) for the article “Robots that can adapt like animals” (Nature, 2015).
- “2016 ISAL Award for Outstanding Paper of 2015 in the field of Artificial Life”, awarded by the International Society for Artificial Life to Jean-Baptiste Mouret and his co-authors (Antoine Cully, Jeff Clune, Danesh Tarapore) for the article “Robots that can adapt like animals” (Nature, 2015).

MADYNES Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Masdin associate team

Thanks to previously existing collaborations, a new associate team with SnT at University of Luxembourg has been created in 2016 with a focus on softwarization of networks.

MAGRIT Project-Team (section vide)

MIMESIS Team (section vide)

MULTISPEECH Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

We ranked 1st ex aqueo for the "Professionally produced music recordings" task of the 2016 Signal Separation Evaluation Campaign (SiSEC) [39].

NEUROSYS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Laurent Bougrain has co-supervised and co-written a two-volume book for anyone who uses Brain-Computer Interfaces, in English [17], [18] and for the first time in French [19], [20]. The multidisciplinary work has involved around fifty authors from various backgrounds, who write about their particular area of expertise in a way that makes it accessible to a wider audience. That includes healthcare professionals, video game developers, researchers and students, as well as a much wider audience, curious to explore the philosophical and ethical aspects of this subject. The book also has a practical side, with tutorials illustrating the use of BCI and the OpenViBE software platform (see 6.6 and <http://openvibe.inria.fr>). Laurent Bougrain contributed to several chapters about the state of the art, medical applications and OpenViBE [15], [10], [12], [13] (French version: [16], [9], [11], [14]).
- We stepped up our collaboration with the *department of neurology of the university hospital in Nancy* (Louise Tyvaert, Louis Maillard, Laurent Koessler) leading to i) a **project PEPS JCJC** on modeling and simulation of the oscillatory activity of the memory system during sleep and under general anesthesia (see section 9.2) a **PhD thesis** started in October 2016 (Amélie Aussel), funded by UL and co-supervised by Laure Buhry (Loria-Neurosys) and Radu Ranta (CRAN). This thesis will make use of SEEG recordings made in epileptic patients and will use preliminary results on hippocampal modelling obtained thanks to the project PEPS JCJC.

ORPAILLEUR Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- The conference paper got the best paper award at the International Conference on Concept Lattices and Applications 2016 in Moscow, July 2016 (<https://cla2016.hse.ru/awards>). This reward was given to the paper and also to the whole work on the formalization of functional dependencies done by the four authors during the last years.
- In July 2016, Chedy Raïssi visited NASA Ames and SETI Institute as part of the Frontier Development Lab. He worked there for six weeks on the planetary defense community and focused on Delay-Doppler radar imaging. This stay was organized in the framework of the NASA “Asteroid Grand Challenge” program, where participation is based on a strong selection process.

BEST PAPERS AWARDS :

[33] **Thirteenth International Conference on Concept Lattices and Their Applications (CLA 2016)**. V. CODOCEDO, J. BAIXERIES, M. KAYTOUE, A. NAPOLI.

PESTO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Steve Kremer gave a keynote talk at the 29th IEEE Computer Security Foundations Symposium (CSF'16).

5.1.1. Awards

Véronique Cortier, Antoine Dallon and Stéphanie Delaune received the EASST best paper award of the ETAPS conference for the paper [24].

BEST PAPERS AWARDS :

[24] **5th International Conference on Principles of Security and Trust (POST'16)**. V. CORTIER, A. DALLON, S. DELAUNE.

SEMAGRAMME Project-Team (section vide)

SPHINX Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The CANUM (“Congrès d’Analyse Numérique”, Conference on Numerical Analysis) is the major French-speaking conference on numerical analysis and scientific computing. It is held since 1967 (every year from 1967 to 2000, every two years from 2000). In 2016, the Institut Élie Cartan de Lorraine was in charge of the organization. Most of the members of our team were involved throughout the year. In particular, Karim Ramdani was head of the organizing committee.

TONUS Team (section vide)

TOSCA Project-Team (section vide)

VEGAS Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Inria signed a contract for the integration of ISOTOP within Maple.

The project-team VEGAS will terminate at the end of 2016. A new project-team GAMBLE (Geometric Algorithms and Models Beyond the Linear and Euclidean realm) is currently submitted. It intends to extend computational geometry to non-linear objects, non-Euclidean spaces and probabilistic complexities.

VERIDIS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Jasmin Blanchette was awarded an ERC Starting Grant for his Matryoshka project aiming at fast interactive verification through strong automation for higher-order constructs.

As part of a European network, Pascal Fontaine and Thomas Sturm participate in a new H2020 Coordination and Support Action.⁰ In accordance with the distributed character of Veridis, we are operating nodes at LORIA as well as MPI. Further nodes are located in Austria (University of Linz), Germany (RWTH Aachen; University of Kassel), Italy (Fondazione Bruno Kessler; University of Genova), and the UK (Universities of Bath, Coventry, and Oxford; Maplesoft Europe Ltd.). The CSA aims at improving the integration of communities, methods, and software from SMT solving and symbolic computation [20].

Jasmin Blanchette and Stephan Merz were PC chairs and organizers of the 7th International Conference on Interactive Theorem Proving in Nancy (August 22–27), the main conference of developers and users of proof assistants.

5.1.1. Awards

Mathias Fleury, together with his two supervisors, received the Best Paper Award at IJCAR 2016 for their work on a formalized SAT solver.

Together with Andrew J. Reynolds at the University of Iowa, Jasmin Blanchette was invited to submit a short version of his CADE 2015 paper on a decision procedure for (co)datatypes to the Sister Conference Best Paper Track of IJCAI 2016.

BEST PAPERS AWARDS :

[25] **8th International Joint Conference on Automated Reasoning (IJCAR 2016)**. J. C. BLANCHETTE, M. FLEURY, C. WEIDENBACH.

[19] **IJCAI 2016**. A. REYNOLDS, J. C. BLANCHETTE.

⁰H2020-FETOPEN-2015-CSA-712689, <http://www.sc-square.org/>