Adv. Appl. Clifford Algebras 24 (2014), 253–255

0188-7009/020253-3
published online May 14, 2014
DOI 10.1007/s00006-014-0462-4

Advances in Applied Clifford Algebras

Preface

Christophe Saint-Jean, Michel Berthier and Laurent Fuchs

This special issue of *Advances in Applied Clifford Algebras* contains extended papers from the conference "Applied Geometric Algebras in Computer Science and Engineering" (AGACSE 2012) held at La Rochelle University, France from July 2th to 4th, 2012. This conference was the 5th in this series and gave a particular focus on applications of geometric algebras (Clifford algebras) to signal/image processing and geometric computing. Conference slides and talks are freely available through the conference website:

`http://agacse2012.univ-lr.fr` and
iTunes™ platform under keywords '**AGACSE 2012**'.

The twenty papers of this issue all have been peer reviewed by at least two international experts outside the scientific committee of the conference.

The first series of papers concerns *Geometric Calculus and applications to Physics*. David Hestenes gives a guided and annotated tour on the book "Clifford Algebra to Geometric Calculus" following his tutorial during the conference. Pierre-Philippe Dechant describes an algebraic framework for Coxeter group theoretic computations for which he has received the best paper award. Terje Vold proposes a method for accurately and efficiently simulating or computing values of electromagnetic fields.

Geometric algebras allow to embed a vector space in a higher-dimensional space where geometric transforms are naturally encoded with group actions. In doing so, it illuminates many existing methods for multidimensional signal/image processing and opens the way to new ones. Michel Berthier gives a survey of applications of spin geometry to image processing and proposes different Fourier transforms differing in considered spin characters. Eckhard Hitzer defines general two-sided Clifford Fourier transforms by studying the multivector square roots of -1 in $Cl(p,q)$. Ulises Moya-Sánchez and Eduardo Bayro-Corrochano explore the local symmetry properties of a signal by computing the local phase of a monogenic signal using atomic functions as filters. Jésus Angulo studies different averaging methods over the Lie group of non-zero quaternions with an application to Bilateral filtering for quaternion-valued images. In a similar way, Quentin Barthélemy *et al.* generalize to the

quaternionic case the algorithm of orthogonal matching pursuit yielding a sparse representation of a signal. Roxana Bujack *et al.* propose a detector of misalignment of 3D vector fields with a geometric correlation while Stuart Pollock and Stephen Mann give a method to detect vortices in such vector fields.

Another set of papers concerns *Geometric Computing with Conformal Geometric Algebras* (CGA). For computer vision, Ghina El Mir *et al.* introduce a conformal image representation described by a mapping defined on a horosphere, and leading to model every viewpoint change in the conformal geometry. Mann *et al.* investigate the definition and properties of perspective projections for several homogeneous and conformal models. Julio Zamora-Esquivel defines a generalization of conformal model $Cl(4,1)$ of euclidian space $\mathbb{R}^3$ to encompass quadrics and their transforms with details on its implementation. In an similar purpose, Pablo Colapinto synthesizes 3D meshes using point pair generators as curvature operators while Lucie Druoton *et al.* model the non-degenerate Dupin cyclides and the space of spheres in CGA. In the field of robotics, Luis González-Jiménez *et al.* demonstrate how CGA can be applied to robust pose control of robot manipulators.

A major concern for practitioners is the availability of efficient and provable tools for both symbolic and numerical computations. Due to the high dimension of geometric algebras, these issues have focused much attention from the community so far. Following the lab session on *Symbolic computation with* `Clifford`, Rafał Abłamowicz and Bertfried Fauser give a comprehensive presentation on how the multitasking feature of Maple™ is employed for accelerating Clifford products. In a second paper, they give details about symbolic computation in dimensions higher than 9 using tensor product decompositions and periodicity theorems. Laurent Théry *et al.* propose a formalization of geometric algebras within a proof assistant leading to a verified implementation of it based on binary trees. Patrick Charrier *et al.* present a precompiler for C++ and GPU code from GA algorithms written in higher level languages.

The guest editors (the Chairs of AGACSE 2012) would like to thank the authors for their contributions, the reviewers for their cooperations in the editorial process and our partners (especially the "Région Poitou-Charentes", "MIRES" research federation and La Rochelle and Poitiers universities) for their financial and technical support.

Chairs of AGACSE'2012

Publisher's Erratum

Due to an mistake in the transfer to production on our side, two of the contributions have already been published in Volume 24, issue 1 of *Advances in Applied Clifford Algebras*. This concerns the articles "Boosted Surfaces:

Synthesis of Meshes using Point Pair Generators as Curvature Operators in the 3D Conformal Model", by Pablo Colapinto (pages 71–88 of that issue) and "A Clifford Algebraic Framework for Coxeter Group Theoretic Computations", by Pierre-Philippe Dechant (pages 89–108 of that issue). We deeply apologize for that mistake.

Christophe Saint-Jean and Michel Berthier
Laboratoire MIA
UFR Sciences et Technologie
Université de La Rochelle
Avenue Michel Crépeau
17042 La Rochelle Cedex 1
France
e-mail: christophe.saint-jean@univ-lr.fr
michel.berthier@univ-lr.fr

Laurent Fuchs
Laboratoire XLIM-SIC
Université de Poitiers
Boulevard Marie et Pierre Curie, BP 30179
86962 FUTUROSCOPE Chasseneuil Cedex
France
e-mail: laurent.fuchs@univ-poitiers.fr