Program AGACSE 2010, Amsterdam

(version June 10, 2010)

Monday June 14, 2010

Registration, Coffee and Tea: 9:00-10:30

Opening Session: 10:30-11:30

Chaired by Joan Lasenby

10:30-10:45 **Welcome**
Leo Dorst and Joan Lasenby

10:45-11:30 **The Shape of Differential Geometry**
David Hestenes [pdf]
Arizona State University, Tempe, AZ, USA

Session 1: Rigid Body Motion and Mechanisms, 11:30-13:00

Chaired by Anthony Lasenby

11:30-12:00 **Estimating Motors from a Variety of Geometric Data**
Robert Valkenburg, Leo Dorst [pdf]
Industrial Research Limited, Auckland, NZ

12:00-12:30 **Reconstructing Rotations and Rigid Body Motions from Point Correspondences as a Sequence of Reflections**
Daniel Fontijne, Leo Dorst [pdf]
University of Amsterdam, NL

12:30-13:00 **Line geometry in terms of the Null Geometric Algebra over $R^{3,3}$, and application to the inverse singularity analysis of generalized Stewart platforms**
Lixian Zhang, Hongbo Li [pdf]
Chinese Academy of Sciences, Beijing, CN

Lunch at the Atrium: 13:00-14:30

a university restaurant at Oudezijds Achterburgwal 237, 7 minutes by foot from the conference site

Session 2: Computer Graphics and Algebraic Modelling, 14:30-16:30

Chaired by Chris Doran

14:30-15:00 **Rethinking the Classical Paradigm of the Clifford Algebra for 3-Dimensions: Presenting A Simple Homogeneous Model for Computer Graphics**
Ron Goldman [pdf]
Rice University, Houston, USA

15:00-15:30 **The conformal conic model applied to collision detection**
L. Horna , R. Barrón, M. Olguin, I. Rivera [pdf]
Centro de Investigación en Computación IPN, Distrito Federal, Mexico

15:30-16:00 **Inverse Kinematics solutions using Conformal Geometric Algebra**
Andreas Aristidou, Joan Lasenby [pdf]
University of Cambridge, UK

16:00-16:30 **The Limits of the Conformal Model**
Tim Bouma [pdf]
Portland, OR, USA

Tea and Coffee, 16:30-16:45

Session 3: Smoothing and Interpolation, 16:45-18:15

Chaired by Stephen Mann

16:45-17:15 **Assessing and Improving Smooth Motions Using Energy**
L. Simpson, G. Mullineux [pdf]
University of Bath, UK

17:15-17:45 **Application of Conformal Geometric Algebras in Discrete Invariants and Curve Completion Problems**
Jun Zhao [pdf]
University of Kent, Canterbury, UK

17:45-18:15 **A Piecewise Hermite Quaternion Interpolation**
Rafael Reséndiz, Leonardo Traversoni, Mira Bozzini [pdf]
Universidad Autónoma Metropolitana, Iztapalapa, Mexico

Welcome Drinks and Canal Boat Tour: 19:00-20:30

we embark and debark on the Singel canal near the conference site

Tuesday June 15, 2010

Session 4: Visualization in Computer Graphics, 9:00-10:45

Chaired by Alyn Rockwood

09:00-09:45 **Thoughts from the front line: Current issues in real-time graphics and areas where Geometric Algebra can help.**
Chris Doran [pdf]
Geomerics, Cambridge, UK

09:45-10:15 **On the Geometry of Lightfields**
Oliver Fleischmann, Christian Perwass, Gerald Sommer [pdf]
University of Kiel, Germany

10:15-10:45 **Reciprocal Space and Crystal Planes in Geometric Algebra**
Eckhard Hitzer [pdf]
University of Fukui, Japan

Coffee and Tea, 10:45-11:00

Session 5: Physics and Rigid Body Motion, 11:00-13:00

Chaired by Timothy Havel

11:00-11:30 **Rigid Body Motion and Conformal Geometric Algebra**
A. Lasenby, C. Doran, R. Lasenby [pdf]
University of Cambridge, UK

11:30-12:00 **Geometric Algebra and Metric-neutral Visualization, Kinematics, and Dynamics**
Charles Gunn [pdf]
Technical University Berlin, Germany

12:00-12:30 **Calibration of Target Positions using CGA**
Robert Valkenburg, Nawar Alwesh [pdf]
Industrial Research Limited, Auckland, NZ

12:30-13:00 **Attitude and position tracking / kinematics**
Liam Candy, Joan Lasenby [pdf]
Council for Scientific and Industrial Research, Johannesburg, South Africa

Lunch at the Special Collections Library: 13:00-14:30

a university restaurant at Oude Turfmarkt 129, 5 minutes by foot from the conference site

Session 6: Software, 14:30-16:00

Chaired by Leo Dorst

14:30-15:00 **Gaigen 2.5: Geometric Algebra Implementation Generator**
Daniel Fontijne [pdf]
University of Amsterdam, NL

15:00-15:30 **Runtime performance of a Molecular Dynamics model using Conformal Geometric Algebra**
F. Seybold, D. Hildenbrand, M. Bernreuther, D. Jenz, P. Charrier [pdf]
U. of Stuttgart, Germany

15:30-16:00 **Five Minute Introductions to Software Demonstrations**

Gaigen	Daniel Fontijne	**GAviewer**	Leo Dorst
GAMatlab	Robert Valkenburg	**MV**	Ian Bell
Gaalop	Patrick Charrier	**Gaalet**	Florian Seybold
SGV	Eckhard Hitzer	**GluCat, PyClical**	Paul Leopardi

Session 7: Introductions to Posters, 16:00-16:20

Chaired by Leo Dorst

16:00-16:05 **The GA_c distributed representation model and its applications in databases**
Agnieszka Patyk [pdf]
Gdánsk University of Technology, Poland

16:05-16:10 **Pattern Recognition Based on Space Folding Model**
M. T. Pham, T. Yoshikawa, T. Furuhashi [pdf]
Nagoya University, Japan

16:10-16:15 **Electromagnetic energy-momentum tensor via Noether theorem and the tetraquaternion Grassmann-Hamilton-Clifford algebra**
P. Girard, R. Pujol [pdf]
University of Lyon, France

16:15-16:20 **Structure of Noether's Conservation Laws**
Tania M. N. Gonçalves, Elizabeth L. Mansfield [pdf]
University of Kent, Canterbury, United Kingdom

mentioned **A geometric radial function network for tracking**
E. Vázquez-Santacruz, E. Bayro-Corrochano [pdf]
Unidad Guadalajara, Mexico

mentioned **Geometric Hough transform for robot vision**
M. Bernal-Marin, E. Bayro-Corrochano [pdf]
Unidad Guadalajara, Mexico

mentioned **Applications of Potential Fields and Conformal Geometric Algebra for Humanoid Manipulation Maneuvering**
O. Carbajal-Espinosa, E. Bayro-Corrochano, A. Loukianov [pdf]
Unidad Guadalajara, Mexico

Software Demonstrations and Posters, with Tea and Coffee 16:20-18:45

in the front hall

Conference Dinner at 'Kantjil en de Tijger', 19:00

an Indonesian restaurant, 1 minute by foot from the conference site (Spuistraat 291-293)

Wednesday June 16, 2010

Session 8: Mathematics and Combinatorics, 9:00-10:30

Chaired by Eckhard Hitzer

09:00-09:30 **Introduction to the Symbolic Invariant Calculus with Applications**
Elizabeth L. Mansfield [pdf]
University of Kent, Canterbury, UK

09:30-10:00 **Algorithm specification and implementation for theorem proving with null geometric algebra**
Yuanhao Cao, Hongbo Li [pdf]
Chinese Academy of Sciences, Beijing, CN

10:00-10:30 **On the Complexity of Cycle Enumeration Using Zeons**
René Schott, G. Stacey Staples [pdf]
Southern Illinois University Edwardsville, Illinois, USA

Coffee and Tea, 10:30-11:00

Session 9: Computational Geometry, 11:00-13:00

Chaired by Hongbo Li

11:00-11:30 **Applications of Geometric Algebra and the Geometric Product to solve Geometric Problems**
Ramon Gonzalez Calvet [pdf]
Universitat Autónoma de Barcelona, Spain

11:30-12:00 **On the Use of Conformal Geometric Algebra to Construct Covering Spheres**
L. Horna , R. Barrón, M. Olguin, I. Rivera [pdf]
Centro de Investigación en Computación IPN, Distrito Federal, Mexico

12:00-12:30 **On the Use of Geometric Algebra in Geometrical Constraint Solving**
P. Serré, N. Anwer, Y. Jianxin [pdf]
Supméca, Saint-Ouen, France

12:30-13:00 **Polyhedral Embedding of a Topological Structure**
T. Bellet, A. Arnould, L. Fuchs [pdf]
University of Poitiers, France

Lunch at the Special Collections Library: 13:00-14:30

a university restaurant at Oude Turfmarkt 129, 5 minutes by foot from the conference site

Session 10: Algorithms in GA, 14:30-17:00

Chaired by Gerik Scheuermann

14:30-15:00 **Square Root and Logarithm of Rotors in 3D CGA**
Leo Dorst, Robert Valkenburg [pdf]
University of Amsterdam, NL

15:00-15:30 **Approximating the square root and logarithm functions in Clifford algebras: what to do in the case of negative eigenvalues?**
Paul Leopardi [pdf]
Australian National University, Canberra, AUS

15:30-16:00 **Computing the Grasmannian in Projective Space**
Neil Gordon [pdf]
University of Hull, UK

16:00-16:30 **A Framework for n-dimensional Visibility Computations**
L. Aveneau, S. Charneau, L. Fuchs, F. Mora [pdf]
University of Poitiers, France

Tea and Coffee, 16:30-16:45

Session 11: Color and Signal Processing, 17:15-18:15

Chaired by Joan Lasenby

16:45-17:15 **A Color Extension of the Monogenic Signal – Block-Matching Based Color Object Tracking**
G. Demarcq, M. Berthier, L. Mascarilla [pdf]
Université de La Rochelle, France

17:15-17:45 **A Phase Correlation for Color Images using Clifford Algebra**
José Mennesson, Christophe Saint-Jean, Laurent Mascarilla [pdf]
University of La Rochelle, France

17:45-18:15 **Quaternion Atomic Function Wavelet for Image Processing**
E. U. Moya-Sanchez, E. Bayro-Corrochano [pdf]
Unidad Guadalajara, Mexico

Closing Session: 18:15-18:30

18:15-18:30 **Farewell, and presentation of the next AGACSE team (?!)**
Leo Dorst and Joan Lasenby

Thursday June 17, 2010

Optional Visit to Aalsmeer Flower Auction

7:30 - 11:00	We can visit Aalsmeer Flower Auction, an hour from central Amsterdam by public transportation, and close to the airport. Here 20 million flowers are traded every morning. You can see and smell the flowers, and admire the efficiently operating auction rooms. The auction opens daily at 7:00 and the earlier you get there, the better. Although you can travel there by yourself (by bus 172, it takes 1 hour, leaves every 15 minutes), it is more fun to coordinate. We will collect a group to travel together from the bus terminal in front of Central Station by the 7:36 bus. Should you travel home this morning, bus 198 runs from the auction to the airport.

Presentation Summaries

The Shape of Differential Geometry
David Hestenes – *Arizona State University, Tempe, AZ, USA* [pdf]
hestenes@asu.edu
The grandfather of geometric algebra shows us how the shape operator describes differential geometry in GA, and how it is used in practice.

Estimating Motors from a Variety of Geometric Data
Robert Valkenburg, Leo Dorst – *Industrial Research Limited, Auckland, NZ* [pdf]
r.valkenburg@irl.cri.nz
Motors represent rigid body motions in 3D CGA. Motor estimation is crucial to applications such as pose determination and tracking. This paper shows how to estimate motors optimally from a combination of possibly noisy geometric observation on points, lines, planes, circles etc.

Reconstructing Rotations and Rigid Body Motions from Point Correspondences as a Sequence of Reflections
Daniel Fontijne, Leo Dorst – *University of Amsterdam, NL* [pdf]
fontijne@science.uva.nl
A surprisingly simple algorithm has been found to determine motions from point correspondences in nD. Even the result for 3D rotations from point pairs (which also applies to quaternion determination), is faster than existing methods.

Line geometry in terms of the Null Geometric Algebra over $R^{3,3}$, and application to the inverse singularity analysis of generalized Stewart platforms
Lixian Zhang, Hongbo Li – *Chinese Academy of Sciences, Beijing, CN* [pdf]
hli@mmrc.iss.ac.cn
The geometric algebra of null vectors over $R^{3,3}$ is used to describe the geometry of projective lines and applied to the singularity analysis of parallel manipulators, an example of which is the well known Stewart platform.

Rethinking the Classical Paradigm of the Clifford Algebra for 3-Dimensions: Presenting A Simple Homogeneous Model for Computer Graphics
Ron Goldman – *Rice University, Houston, USA* [pdf]
rng@rice.edu
A 4D geometric algebra for *mass-points* is developed as a language to replace the 'projective geometry' approach in conventional computer graphics. It is compared to the existing 5D CGA framework.

The conformal conic model applied to collision detection
L. Horna , R. Barrón, M. Olguin, I. Rivera – *Centro de Investigación en Computación IPN, Distrito Federal, Mexico* [pdf]
chornab08@sagitario.cic.ipn.mx
Inspired by the 5D conformal geometric algebra, the *conformal conic model* provided a framework to manipulate conics. Here this framework is applied to collision detection with applications in computer graphics.

Inverse Kinematics solutions using Conformal Geometric Algebra
Andreas Aristidou, Joan Lasenby – *University of Cambridge, UK* [pdf]
aaa462@cam.ac.uk
A novel inverse kinematics solver working with all chain classes is presented. The solver is described in the CGA framework to facilitate easy incorporation of joint and movement constraints.

The Limits of the Conformal Model
Tim Bouma – *Portland, OR, USA* [pdf]
pdxtim@quantumneighborhood.com
There are several processses by which one may take limits in the conformal model. This paper will discuss one such process which leads to a natural embedding of tangent objects.

Assessing and Improving Smooth Motions Using Energy
L. Simpson, G. Mullineux – *University of Bath, UK* [pdf]
l.c.simpson@bath.ac.uk
This paper uses a particular form of GA (where one basis element squares to infinity) to describe rigid body motions and also addresses the problem of interplolation of such motions via an energy approach.

Application of Conformal Geometric Algebras in Discrete Invariants and Curve Completion Problems
Jun Zhao – *University of Kent, Canterbury, UK* [pdf]
jz45@kent.ac.uk
The problem of joining spatially separated curves is addressed. Euler-Lagrange equations are set up and solved to produce such an interpolating path in a smooth and covariant manner.

A Piecewise Hermite Quaternion Interpolation
Rafael Reséndiz, Leonardo Traversoni, Mira Bozzini – *Universidad Autónoma Metropolitana, Iztapalapa, Mexico* [pdf]
rafael.resendiz@gmail.com
The ideas behind using cubic Hermite curves to interpolate between end points with constraints in R^3 are extended to develop a method for using Hermite quaternion 'curves' in $SO(3)$ for interpolation between constrained quaternions.

Thoughts from the front line: Current issues in real-time graphics and areas where Geometric Algebra can help.
Chris Doran – *Geomerics, Cambridge, UK* [pdf]
c.doran@mrao.cam.ac.uk
The author runs an advanced graphics effects company using software based on geometric algebra. He gives his view on what problems GA resesrch might usefully address next. Interestingly, he views Haskell as the next killer application of GA.

On the Geometry of Lightfields
Oliver Fleischmann, Christian Perwass, Gerald Sommer – *University of Kiel, Germany* [pdf]
ofl@ks.informatik.uni-kiel.de
This paper calls into question the conventional parameterisation of the *lightfield* and describes a new GA parameterisation. Examples of how this more intuitive geometric approach simplifies image acquisition are given.

Reciprocal Space and Crystal Planes in Geometric Algebra
Eckhard Hitzer – *University of Fukui, Japan* [pdf]
hitzer@mech.u-fukui.ac.jp
The author shows how GA can be used to represent and derive many features of crystal cells. In particular, the concept of the reciprocal frame is used to great advantage, simplifying much of the conventional procedure.

Rigid Body Motion and Conformal Geometric Algebra
A. Lasenby, C. Doran, R. Lasenby – *University of Cambridge, UK* [pdf]
a.n.lasenby@mrao.cam.ac.uk
Here an attempt at a coherent unified treatment of rigid body motion, based on a Lagrangian formulation, is given. The resulting setup is applied to both non-interacting and interacting rigid bodies.

Geometric Algebra and Metric-neutral Visualization, Kinematics, and Dynamics
Charles Gunn – *Technical University Berlin, Germany* [pdf]
gunn@math.tu-berlin.de
Starting from a Kleinian view of geometry, this paper shows how Euclidean, elliptical and hyperbolic geometries can be implemented in GA. The connection with dual quaternions will be discussed and thus also the application to kinematics and dynamics.

Calibration of Target Positions using CGA
Robert Valkenburg, Nawar Alwesh – *Industrial Research Limited, Auckland, NZ* [pdf]
r.valkenburg@irl.cri.nz
When calibrating an optical measurement system, measured directions need to be combined optimally to determine the targets. This paper gives a compact formulation of the closed form solution in 3D CGA, how to implement it in classical LA software, and measurements on the resulting accuracy.

Attitude and position tracking / kinematics
Liam Candy, Joan Lasenby – *Council for Scientific and Industrial Research, Johannesburg, South Africa* [pdf]
lpc28@cam.ac.uk
In conventional navigation an equation termed the *Bortz Equation* (BE) is used to accurately track attitude (pose). Here the GA derivation of the BE is given and the methodology is extended via CGA to a give a modified BE to deal simultaneously with position and pose.

Gaigen 2.5: Geometric Algebra Implementation Generator
Daniel Fontijne – *University of Amsterdam, NL* [pdf]
fontijne@science.uva.nl
A new and even faster version of the Gaigen software has been developed with much added functionality. Among these are fast exponentials, logarithms and trigonometric and hyperbolic functions for multivectors. This talk presents and explains the new version.

Runtime performance of a Molecular Dynamics model using Conformal Geometric Algebra
F. Seybold, D. Hildenbrand, M. Bernreuther, D. Jenz, P. Charrier – *U. of Stuttgart, Germany* [pdf]
seybold@hlrs.de
A molecular dynamics (MD) model can consist of rigid molecules which interact via point pair potentials. In this paper the runtime performance of an MD solver based on the CGA framework is compared with that of conventional methods.

The GA_c distributed representation model and its applications in databases
Agnieszka Patyk – *Gdánsk University of Technology, Poland* [pdf]
patyk@pg.gda.pl
This poster looks at the question of using distributed representations to implement databases with complex contents. The author describes a version of GA which attempts to encode attributes via high dimensional vectors.

Pattern Recognition Based on Space Folding Model
M. T. Pham, T. Yoshikawa, T. Furuhashi – *Nagoya University, Japan* [pdf]
minhtuan@cmplx.cse.nagoya-u.ac.jp
This poster proposes the use of geometric algebra as a model for improved classification. The authors improve a supervised learning algorithm based on projection to an optimal orthogonal basis with respect to discrimination of classes (like LDA) by allowing non-orthogonal basis vectors. The approach is tested on handwritten digits from the UCI Repository for classification problems.

Electromagnetic energy-momentum tensor via Noether theorem and the tetraquaternion Grassmann-Hamilton-Clifford algebra

P. Girard, R. Pujol – *University of Lyon, France* [pdf]
patrick.girard@creatis.insa-lyon.fr

A pedagogical contribution which develops an algebraic formulation of Hamilton's principle and Noether's Theorem without the use of exterior differential forms. A 4D GA is used to derive the electromagnetic energy-momentum tensor and the importance of trivectors in the expression of conserved quantities is emphasized.

A geometric radial function network for tracking

E. Vázquez-Santacruz, E. Bayro-Corrochano – *Unidad Guadalajara, Mexico* [pdf]
edb@gdl.cinvestav.mx

The ambition of the authors is to consider 3D rigid body motions as the motion group for tracking; the case of rotations is treated.

Geometric Hough transform for robot vision

M. Bernal-Marin, E. Bayro-Corrochano – *Unidad Guadalajara, Mexico* [pdf]
edb@gdl.cinvestav.mx

This poster describes reformulating the Hough transform into conformal geometric algebra for use in a robot vision system.

Applications of Potential Fields and Conformal Geometric Algebra for Humanoid Manipulation Maneuvering

O. Carbajal-Espinosa, E. Bayro-Corrochano, A. Loukianov – *Unidad Guadalajara, Mexico* [pdf]
edb@gdl.cinvestav.mx

This poster aims at developing a CGA version of the potential fields collision avoidance method for robot arms.

Introduction to the Symbolic Invariant Calculus with Applications

Elizabeth L. Mansfield – *University of Kent, Canterbury, UK* [pdf]
e.l.mansfield@kent.ac.uk

This paper uses the definition of a moving frame as an equivariant map from a manifold M to a Lie group G where there exists a smooth action of G on M. This idea is developed and illustrated via analysis of the structure of specific Euler-Lagrange systems.

Algorithm specification and implementation for theorem proving with null geometric algebra

Yuanhao Cao, Hongbo Li – *Chinese Academy of Sciences, Beijing, CN* [pdf]
hli@mmrc.iss.ac.cn

Advanced invariants are proposed as a basis for geometric computing and theorem proving. The framework of CGA and operators in this algebra are used to simplify the polynomials of advanced invariants and this implementation of this process is described in detail.

On the Complexity of Cycle Enumeration Using Zeons

René Schott, G. Stacey Staples – *Southern Illinois University Edwardsville, Illinois, USA* [pdf]
sstaple@siue.edu

This contributions deals with enumerating k-cycles in simple graphs on n vertices using the *zeon algebra*. A zeon algebra is a commutative subalgebra of a constrained Grassmann algebra.

Applications of Geometric Algebra and the Geometric Product to solve Geometric Problems

Ramon Gonzalez Calvet – *Universitat Autónoma de Barcelona, Spain* [pdf]
rgonzalezcalvet@gmail.com

This paper will illustrate how GA is a powerful tool for solving geometric problems and one which naturally encompasses many other algebraic frameworks. Examples of the power of the geometric product in Euclidean geometry will be presented.

On the Use of Conformal Geometric Algebra to Construct Covering Spheres

L. Horna , R. Barrón, M. Olguin, I. Rivera – *Centro de Investigación en Computación IPN, Distrito Federal, Mexico* [pdf]
chornab08@sagitario.cic.ipn.mx

The CGA framework is investigated as a language for the construction of *covering spheres* which are fundamental constructs in aspects of computational geometry, e.g. in Delauney triangulation and Voronoi diagrams.

On the Use of Geometric Algebra in Geometrical Constraint Solving

P. Serré, N. Anwer, Y. Jianxin – *Supméca, Saint-Ouen, France* [pdf]
philippe.serre@supmeca.fr

The authors use CGA to represent both geometric objects and constraints in the field of Computer Aided Design (CAD) systems. Examples are given for five common geometric constraints in order to illustrate the functionality of this method.

Polyhedral Embedding of a Topological Structure

T. Bellet, A. Arnould, L. Fuchs – *University of Poitiers, France* [pdf]
Laurent.Fuchs@sic.univ-poitiers.fr

This paper develops a consistent data structure for n-D polyhedra. This is done by working in terms of elements known as *darts* linked by *involutions* and then interpreting this approach in terms of GA.

Square Root and Logarithm of Rotors in 3D CGA

Leo Dorst, Robert Valkenburg – *University of Amsterdam, NL* [pdf]
l.dorst@uva.nl

For the purpose of interpolation of conformal motions, one needs logarithms and square roots of rotors. Using a new norm for even multivectors in 3D CGA, closed form formulas are given for *polar decomposition* and *bivector split*, which in turn produce formulas for roots and logs.

Approximating the square root and logarithm functions in Clifford algebras: what to do in the case of negative eigenvalues?

Paul Leopardi – *Australian National University, Canberra, AUS* [pdf]
paul.leopardi@maths.anu.edu.au

This paper considers the matrix representations of functions in Clifford Algebras. In particular, the square root and the logarithm of multivectors are investigated in the cases when the representative matrix has negative eigenvalues.

Computing the Grasmannian in Projective Space

Neil Gordon – *University of Hull, UK* [pdf]
n.a.gordon@hull.ac.uk

The Grassmannian is viewed as a function that characterises decomposable bivectors. The computation of this function in certain vector spaces is derived. Symbolic algebra is used to locate the projective points characterised by the Grassmannian.

A Framework for n-dimensional Visibility Computations
L. Aveneau, S. Charneau, L. Fuchs, F. Mora – *University of Poitiers, France* [pdf]
lilian.aveneau@xlim.fr
The problem of *visibility* concerns whether or not objects are connected by uninterrupted lines. Here, a GA approach to computing visibility is developed which holds in any dimension. Examples of this approach to generate soft shadows are given.

A Phase Correlation for Color Images using Clifford Algebra
José Mennesson, Christophe Saint-Jean, Laurent Mascarilla – *University of La Rochelle, France* [pdf]
jose.mennesson@univ-lr.fr
The authors use GA to produce a generalisation of the Fourier transform, which is then applied to the processing of colour images. Using this novel transform, a new colour phase correlation is defined and examples of its use in classification are given.

A Color Extension of the Monogenic Signal – Block-Matching Based Color Object Tracking
G. Demarcq, M. Berthier, L. Mascarilla – *Université de La Rochelle, France* [pdf]
gdemar01@univ-lr.fr
This paper proposes an extension of the monogenic signal to color images, and uses it to construct a new block-matching based tracker. Experiments compare the performance of this tracker with conventional algorithms.

Quaternion Atomic Function Wavelet for Image Processing
E. U. Moya-Sanchez, E. Bayro-Corrochano – *Unidad Guadalajara, Mexico* [pdf]
edb@gdl.cinvestav.mx
Atomic Functions are in general formed by infinite convolutions of rectangular impulses and are used in certain branches of image processing. Here the authors develop a *Quaternionic Atomic Function Wavelet* and use it to filter images when directionality is important.

Linked list of abstracts by (co)authors

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