Sophus Lie Seminar at Nordfjordeid, Norway
June 12-18, 2022

Titles and Abstracts of posters

Ballerin Francesco, University of Bergen, Norway

Sub-Riemannian geometry and its application to Image Processing.

Abstract. A $2D$ image is perceived by the human brain through the visual cortex $V1$, a part of the occipital lobe which is sensitive to orientation. This sensitivity intrinsically fills gaps in the perceived image depending on the gradient of the image in a neighborhood, restoring the perceived data in case of corruption. The visual cortex $V1$ can be mathematically modeled as $SE(2)$, a sub-Riemannian geometry which can be exploited to produce image restoration algorithms.

Bispo Asmus K., Ghent University, Belgium

Branching laws and basis construction for infinite dimensional $\mathfrak{osp}(1|2n)$-modules.

Abstract. The branching laws associated to the embedding $\mathfrak{gl}(n) \subset \mathfrak{osp}(1|2n)$ let us construct new explicit bases for a class of infinite dimensional irreducible $\mathfrak{osp}(1|2n)$-modules $L(p)$ characterized by a positive integer p. The basis elements are initially defined as the elements of Poincare-Birkhoff-Witt-type monomials bases for each of the modules in the irreducible decomposition of $L(p)$ as a $\mathfrak{gl}(n)$-module and are afterwards described as polynomials in the generators of $\mathfrak{osp}(1|2n)$ acting on a lowest weight vector of $L(p)$. Using a relationship between Poincare-Birkhoff-Witt-type monomials bases and Gelfand-Zetlin bases for irreducible $\mathfrak{gl}(n)$-modules we are able to explicitly describe the elements of the Gelfand-Zetlin basis for the $\mathfrak{osp}(1|2n)$- module $L(p)$ as polynomials in the generators of $\mathfrak{osp}(1|2n)$ acting on a lowest weight vector of $L(p)$.

This is joint work with Joris Van der Jeugt.

Di Pinto Dario, University of Bari Aldo Moro, Italy

Geometric structures on the Heisenberg Lie group.

Abstract. TBA

Galici Mario, University of Palermo, Italy

Toroidal groups, generalized Jacobians and non-totally real number fields.

Abstract. A toroidal group is a complex Lie group on which every holomorphic function is constant. In this poster session, the relationship between toroidal groups and non-totally real number fields is introduced: under some necessary assumptions, any toroidal group $\mathcal{T}$ of complex dimension 2 and real rank 3 with extra multiplication is isogenous to the group $\mathbb{C}^2/\mu_\Phi(\mathcal{O}_K)$, where K is the non-totally real cubic number field $End_0(\mathcal{T}) = End(\mathcal{T}) \otimes_{\mathbb{Z}} \mathbb{Q}$ and μ_Φ is a Minkowski embedding. Here I give an explicit description of the n-torsion in the geometric correspondence of $\mathcal{T} = \mathbb{C}^2/\mu_\Phi(\mathcal{O}_K)$ with a generalized Jacobian J of an elliptic curve. Moreover I write down the relations between the parameters defining J and the field K. Furthermore, for such a toroidal group $\mathcal{T}$, I explicitly show the analytic and rational representations of its ring of endomorphisms. Lastly, I show some results concerning the case of toroidal groups of complex dimension 3 and real rank 4.

Schlarb Markus, University of Würzburg, Germany

A multi-parameter Family of pseudo-Riemannian Metrics on Stiefel Manifolds.

Abstract. The real (compact) Stiefel manifold $\mathrm{St}_{n,k}$ is considered from an extrinsic point of view, i.e. as an embedded submanifold of the real $(n\times k)$-matrices $\mathbb{R}^{n\times k}$. A multi-parameter family of pseudo-Riemannian metrics on an open $U \subseteq \mathbb{R}^{n\times k}$ is introduced such that $\mathrm{St}_{n,k} \subseteq U$ becomes a pseudo-Riemannian submanifold. This family contains many known (pseudo-)Riemannian metrics on $\mathrm{St}_{n,k}$. In particular, a one-parameter family, called α-metrics, which has been recently introduced, is included. Closed form expressions for the orthogonal projections onto tangent spaces as well as the geodesic equation as an explicit matrix-valued second order ODE can be derived for all metrics in this family. In addition, for a subfamily, one obtains explicit formulas for pseudo-Riemannian gradients, pseudo-Riemannian Hessians as well as the Levi-Civita covariant derivative.

Suchánek Radek, Masaryk University, Czechia, and
University of Angers, France

Generalized Geometry of 2-Forms Over the $4D$ Cotangent Bundle.

Abstract. Differential 2-forms living on $4D$ cotangent bundle T^*M defines second-order PDEs on $2D$ base manifold M. These PDEs are called symplectic Monge-Ampére equations. They arise, for example, in the context of CR-manifolds, Kähler geometry, self-dual Einstein gravity, and semi-geostrophy. We are interested in the construction of generalized geometries (as introduced by Hitchin and Gualtieri) using geometric structures naturally associated with Monge-Ampère equations, such as almost complex structure, almost product structure, and symmetric bilinear field, which may happen to be an inner product.

Vercleyen Gert, University of Maynooth, Ireland

On low rank fusion rings.

Abstract. We present a method to generate all fusion rings of a specific rank and multiplicity. This method was used to generate exhaustive lists of fusion rings up to order 9 for several multiplicities. We generalize the Tambara-Yamagami and Haagerup-Izumi constructions and review the structure of non-Abelian fusion rings with a subgroup. A website containing data on fusion rings is introduced and an introduction to a Wolfram Language package for working with these rings is given.