CIMPA-SOUTH AFRICA RESEARCH SCHOOL

Algebraic Representation Theory 2015

http://workshoponalgebraiccombinatorics2015.weebly.com/

JULY 19-31, 2015

AIMS-SOUTH AFRICA, MUIZENBERG, CAPE TOWN

AIMS African Institute for Mathematical Sciences

Welcome from the organizing committee

It is our great honour and pleasure to welcome you all to the CIMPA-SOUTH AFRICA RESEARCH SCHOOL on Algebraic Representation Theory and Applications in this beautiful town of Muizenberg.

The primary focus of the RESEARCH SCHOOL shall be Representation Theory of Lie algebras and Group Theory. The main goal of this research school will be to address aspects of the interplay that exists and explore further the interactions between finite groups and infinite dimensional Lie algebras, connections between quantum groups and knot theory.

The School is multidisciplinary, spanning the fields of finite groups, representation theory and combinatorial structures, Kac-Moody algebras, vertex operators and applications, modular representations of the Symmetric group, Representation Theory of Lie Algebras, topologizing filters on rings, symmetries on groups, and Ramsey theory. The main emphasis of the research school is on the interactions between finite groups and infinite dimensional Lie algebras, connections between quantum groups and knot theory.

We are pleased to know that the most reknown experts in this area agreed to come. Also the list of mini-course lecturers and one-hour lecturers is very distinguished and we are looking forward to having a great interaction with exciting discussions.

We thank AIMS-South Africa, CIMPA, the Hanno Rund Fund from the School of Mathematics, Statistics and Computer Science at the University of KwaZulu-Natal, Centre of Excellence in Mathematical and Statistical Sciences (CoE-MaSS), CDC-International Mathematical Union, Office of Naval Research Science and Technology and the National Research Foundation through its Knowledge, Interchange and Collaborations programme for their generous funding of the research school.

AIMS-South Africa is located in Muizenberg, a small seaside suburb of Cape Town and an area of outstanding natural beauty. The site is a half hour drive away from the four local Universities, the centre of Cape Town and the Cape Town international airport.

Once again, welcome to Muizenberg. Please let us know if there is anything we can help you with to ensure that you have a great time during your stay in Muizenberg.

Vyacheslav Futorny
Olivier Mathieu
Bernardo Rodrigues

Programme

Monday, 20 July 2015

7:45-8:30	- *Breakfast*
9:00-9:45	- *Registration*
9:45-10:00	- *Opening and welcome*
10:10-11:00	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
12:30-13:30	Lunch break
13:30-14:00	IT consultation/laptop registration

14:00-14:50	John van den Berg - *An introduction to topologizing filters on rings*
15:00-15:30	Cofee /Tea Break
15:30-16:20	John van den Berg - *An introduction to topologizing filters on rings*
18:00-18:30	Dinner

Tuesday, 21 July 2015

7:45-8:30	- *Breakfast*
8:40-9:30	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
09:40-10:30	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
10:30-11:00	Cofee /Tea Break
11:00-11:40	Jamshid Moori - *Problem session*
11:50-12:30	John van den Berg - *An introduction to topologizing filters on rings*
12:30-13:30	Lunch break
13:30-14:00	IT consultation/laptop registration

14:00-14:50	John van den Berg - *An introduction to topologizing filters on rings*
15:00-15:30	Cofee /Tea Break
15:30-16:20	John van den Berg - *Problem session*
18:00-18:30	Dinner

Wednesday, 22 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
10:00-10:50	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Iryna Kashuba - *Characters of finite groups*
12:30-13:40	Lunch break
13:30-14:00	Research school group photo

14:00-15:00	- *Individual work session*
15:00-15:30	Cofee /Tea Break
15:30-17:00	- *Individual work session*
18:00-18:30	Dinner

Thursday, 23 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
10:00-10:50	Jamshid Moori - *Finite groups, representation theory and combinatorial structures*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
12:30-14:00	Lunch

14:00-14:50	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
15:00-15:30	Cofee /Tea Break
15:30-16:20	Iryna Kashuba - *Characters of finite groups*
16:30-17:20	Iryna Kashuba - *Characters of finite groups*
18:00-18:30	Dinner

Friday, 24 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	John van den Berg - *An introduction to topologizing filters on rings*
10:00-10:50	John van den Berg - *An introduction to topologizing filters on rings*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
12:30-14:00	Lunch break

14:00-14:50	Slava Futorni - *Kac-Moody algebras, vertex algebras and applications*
15:00-15:30	Cofee /Tea Break
15:30-16:20	Olivier Mathieu - *Modular representations of symmetric groups*
16:30-17:20	Olivier Mathieu - *Modular representations of symmetric groups*
18:00-18:30	Dinner

Saturday, 25 July 2015

09:00-17:00	- *Cape Town Peninsula Tour*

Monday, 27 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Olivier Mathieu - *Modular representations of symmetric groups*
10:00-10:50	Olivier Mathieu - *Modular representations of symmetric groups*
11:30-11:30	Cofee /Tea Break
11:30-12:20	Evgeny Mukhin - *Tame representations of quantum affine algebras*
12:30-14:00	Lunch break

14:00-14:50	Alexander Molev - *Higher Sugawara operators*
15:00-15:30	Cofee /Tea Break
15:30-16:20	Ben Cox - *TBA*
16:30-17:20	Iryna Kashuba - *TBA*
18:00-18:30	Dinner

Tuesday, 28 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Olivier Mathieu - *Modular representations of symmetric groups*
10:00-10:50	Olivier Mathieu - *Modular representations of symmetric groups*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Jennifer Key - *Some open conjectures on linear codes from finite planes*
12:30-14:00	Lunch

14:00-14:50	Bernardo Rodrigues - 2-*modular representations of finite simple groups as binary codes*
15:00-15:30	Cofee /Tea Break
15:30-16:20	Hung Tong-Viet - *Derangements in primitive permutation groups and applications*
18:00-18:30	Dinner

Wednesday, 29 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
10:00-10:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Jonathan Hall - *Axial algebras and their Miyamoto groups*
12:30-13:40	Lunch break
13:40-14:00	Research school group photo

14:00-15:00	- *Individual work session*
15:00-15:30	Cofee /Tea Break
15:30-17:00	- *Individual work session*
18:00-18:30	Dinner

Thursday, 30 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
10:00-10:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Ivan Shestakov - *Representations of Jordan superalgebras*
12:30-14:00	Lunch

14:00-14:50	Manuel Saorin - *The period and Calabi-Yau dimension on finite dimensional mesh algebras*
14:50-15:20	Cofee /Tea Break
15:20-16:10	Dag Madsen - *Filtrations in abelian categories determined by a tilting object*
18:00-18:30	Dinner
19:30-	End of research school social

Friday, 31 July 2015

7:45-8:30	- *Breakfast*
9:00-9:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
10:00-10:50	Natasha Rozhkovskaya - *Introduction to quantum groups*
11:00-11:30	Cofee /Tea Break
11:30-12:20	Dean Crnkovic - *Transitive designs constructed from finite groups and related codes*
12:10-14:00	Lunch

14:00-14:50	Jacob Mostovoy - *Sabinin algebras*
15:00-15:30	Cofee /Tea Break
15:30-16:20	Jonathan Hall - *TBA*
18:00-18:40	Dinner and closing

Mini-courses

Finite Groups, Representation Theory and Combinatorial Structures

Jamshid Moori

School of Mathematical and Physical Sciences North-West University, Mafikeng, South Africa
jamshid.moori@nwu.ac.za

The main of the course is to provide sufficient Group Theory and Representation Theory background for constructing Designs and Codes from Finite Groups. The interplay between Finite Groups and Combinatorial Structures would be studied. We will provide the students with properties of Finite Groups, Groups of Small order, Permutation Groups, Some Simple and Linear Groups, Permutation and Linear Representations of Finite Groups, Character Theory.

We will discuss Designs and Codes and introduce two methods for constructing designs and codes from finite groups. We use the properties of these groups to obtain results about designs and codes and their automorphisms. This course will also contain several theoretical and computational problems. The Computational Systems **MAGMA** and **GAP** will be used.

For topics on Group Theory, Character Theory of Finite Groups and on Design and Codes, the following are very useful references:

References

[1] E. F. Assmus, Jr. and J. D. Key. *Designs and their Codes*, Cambridge University Press, 1992, Cambridge Tracts in Mathematics, Vol. 103 (Second printing with corrections, 1993).

[2] I M Issacs, *Character Theory of Finite Groups*, AMS Chelsea Publishing, 2006.

[3] J. J. Rotman, *An Introduction to the Theory of Groups*, Fourth ed., Springer-Verlag, New York, Inc., 1995.

An introduction to topologizing filters on rings

John van den Berg

Department of Mathematics and Applied Mathematics
University of Pretoria, South Africa
john.vandenberg@up.ac.za

Representations of Infinite Dimensional Lie Algebras

Vyacheslav Futorny

USP, Brazil
futorny@ime.usp.br

The goal of this mini-course is to give an introduction to the representation theory of various classes of infinite dimensional Lie algebras including Affine Kac-Moody algebras, elliptic Affine algebras (the latter are particular cases of Krichever-Novikov algebras associated with elliptic curves) and Lie algebras of vector fields on N-dimensional torus. In the first lecture we will discuss free field realizations of Affine Lie algebras based on the theory of vertex algebras which provide a mathematical foundation of 2-dimensional conformal field theory. In the second lecture we will discuss vertex type constructions for elliptic Affine Lie algebras and their applications. Finally, the third lecture will focus on classical and new results on the representations of Virasoro algebra and its generalizations for an arbitrary torus.

Characters of finite groups

Iryna Kashuba

Institute of Mathematics and Statistics
University of São Paulo, Brazil
kashuba@ime.usp.br

On the representations of the symmetric group

Olivier Mathieu

CNRS
University of Lyon, France
mathieu@math.univ-lyon1.fr

The classical approach of representation theory of the symmetric group S_n is as follows. Each Young diagram Y provides a Schur module ∇_Y. Then the simple representations of the symmetric groups are obtained by using Gram-Schmidt orthogonalisation process to the family of modules ∇_Y. Each step is very elementary, but the combinatorics is difficult to follow (for example the set of Young diagram is only a poset).

By contrast, representation theory of compact Lie groups is more advanced, but the theory including Weyl character formula is much more easy to understand. In the course we will use the Schur Weyl duality. With this approach, representation theory for the symmetric group is a natural consequence of the theory for the groups $SU(n)$.

If time allows, we will also discuss modular representations of S_n.

One-hour lectures

Tame representations of quantum affine algebras

Evgeny Mukhin

IUPUI
USA

We consider finite dimensional representations of quantum affine algebras. It is believed that if V is irreducible then images of Cartan generators form a maximal commutative subalgebra of End(V). In particular, if Cartan generators are diagonalizable in V, then their joint spectrum must be simple. In type A, the latter is a well-known result of M. Nazarov and V. Tarasov. We prove it in type B. In the process, we classify all modules in type B with diagonal action of Cartan currents and explicitly describe the spectrum of Cartan generators.

This talk is based on a joint work with Matheus Brito (UC Riverside, US, and Campinas, Brazil).

Higher Sugawara operators

Alexander Molev

School of Mathematics and Statistics
The University of Sydney
Australia

We will discuss recent constructions of higher Sugawara operators for the affine Kac-Moody algebras at the critical level. Their Harish-Chandra images provide generators of classical W-algebras. We will also consider super and quantum generalizations of these constructions.

TBA

Ben Cox

College of Charleston, USA

TBA

Iryna Kashuba

Institute of Mathematics and Statistics
University of São Paulo, Brazil
kashuba@ime.usp.br

Some open conjectures on linear codes from finite planes

J.D. Key

We consider some open questions regarding codes arising from the row span over a finite field $\mathbb{F}_p$ of a lines by points incidence matrix of a finite projective or affine plane, and in particular those coding-theoretic properties that may distinguish a non-desarguesian from a desarguesian plane, including bounds on the dimension of the p-ary code C, the minimum weight and nature of the minimum weight vectors of the hull, $C \cap C^{\perp}$, and the nature of the minimum weight vectors for an affine plane.

In particular, we show that projective Hall planes of even order q provide an infinite class of planes that confirm the Hamada-Sachar conjecture that the code from the desarguesian plane has the smallest dimension and that these planes, and their duals, are not tame, i.e. there are words in the hull of weight $2q$ that are not the difference of the incidence vectors of two lines [2].

We also exhibit words of weight 16 in several non-desarguesian affine planes of order 16 that are not incidence vectors of lines. This result is from a computer study of the binary codes and their hulls of all the known non-desarguesian projective planes of order 16 [1].

The new results were all obtained by an examination of possible words in the hulls of the projective planes.

References

[1] Dina Ghinelli, Marialuisa J. de Resmini, and Jennifer D. Key, *Minimum words of codes from affine planes*, J. Geom. **91** (2008), 43–51.

[2] J. D. Key, T. P. McDonough, and V. C. Mavron, *Codes from Hall planes of even order*, J. Geom. **105** (2014), 33–41.

2-modular representations of finite simple groups as binary codes

Bernardo Rodrigues

School of Mathematics, Statistics and Computer Science
University of KwaZulu-Natal
Private Bag X54001, Durban 4000
South Africa

Let F be a finite field of q elements, and G be a transitive group on a finite set Ω. Then there is a G-action on Ω, namely a map $G \times \Omega \longrightarrow \Omega$, $(g,w) \mapsto w^g = gw$, satisfying $w^{gg'} = (gg')w = g(g'w)$ for all $g, g' \in G$ and all $w \in \Omega$, and that $w^1 = 1w = w$ for all $w \in \Omega$. Let $F\Omega = \{f \,|\, f{:}\,\Omega \longrightarrow F\}$, be the vector space over F with basis Ω. Extending the G-action on Ω linearly, $F\Omega$ becomes an FG-module called an FG-permutation module. We are interested in finding all G-invariant FG-submodules, i.e., codes in $F\Omega$. The elements $f \in F$ are written in the form $f = \sum_{w\in\Omega} a_w \chi_w$ where χ_w is a characteristic function. The natural action of an element $g \in G$ is given by $g(\sum_{w\in\Omega} a_w \chi_w) = \sum_{w\in\Omega} a_w \chi_{g(w)}$. This action of G preserves the natural bilinear form defined by

$$\langle \sum_{w\in\Omega} a_w \chi_w, \sum_{w\in\Omega} b_w \chi_w \rangle = \sum_{w\in\Omega} a_w b_w.$$

In particular, and by way of illustration we determine all linear codes of length 100 over $\mathbb{F}_2$ which admit the simple group HS of Higman-Sims. By group representation theory it is proved that they can all be understood as submodules of the permutation module $F\Omega$ where Ω denotes the vertex set of the rank-3 graph associated with the simple group HS of Higman-Sims.

Derangements in primitive permutation groups and applications

Hung P. Tong-Viet

Department of Mathematics and Applied Mathematics
University of Pretoria
P. Bag X20, Hatfield, Pretoria 0002
South Africa

A derangement is a permutation with no fixed points. One of the oldest theorem in probability, the Montmort limit theorem, says that the proportion of derangements in finite symmetric groups S_n tends to e^{-1} when n tends to infinity. Also a classical theorem of Jordan implies that every finite transitive permutation groups of degree greater than 1 contains derangements. This result has many applications in number theory, topology, game theory, combinatorics, and character theory. There are several interesting questions on the order and the number of derangements that have attracted much attention in recent years. In this talk, I will discuss some of these questions and I will report on recent results on finite primitive permutation groups with some restriction on derangements. This

is joint work with Timothy C. Burness.

Axial algebras and their Miyamoto groups

Jonathan I. Hall

Department of Mathematics
Michigan State University
E. Lansing, MI 48824-1027

An axial algebra is a commutative (but not necessarily associative) algebra generated by semisimple idempotents (its axes), for each of which the eigenspaces multiply according to a restrictive fusion rule. An example is furnished by the idempotents of a Jordan algebra and their associated Pierce decompositions; but the motivating example is the Griess algebra for the Monster, as recast by Conway and embedded in the Monster Vertex Operator Algebra of Frenkel, Lepowsky, and Meurman. As with a Jordan algebra, the fusion rule can often be refined to a $\mathbb{Z}_2$-grading; and the associated automorphisms of order 2, the Miyamoto involutions, say a great deal about the structure of the algebra. Indeed, for certain special rules they lead to a full classification. For the Griess algebra, the generated Miyamoto group is the Monster in its natural action on the VOA. The techniques and results can be applied to other VOA and related algebras, as well. (The results discussed will include work of Felix Rehren, Sergey Shpectorov, and Tom De Medts.)

Representations of Jordan superalgebras

Ivan Shestakov (IME-USP)

In this talk we plan to give a survey of the recent results obtained in the Representation Theory of Jordan superalgebras. In particular, we will speak on our join result with O.Folleco Solarte on classi cation of irreducible bimodules over the simple Jordan superalgebra of Poisson Grassmann brackets.

The period and Calabi-Yau dimension on finite dimensional mesh algebras

Manuel Saorin

Department of Mathematics
University of Múrcia
msaorinc@um.es

Standard representation-finite triangulated categories were classified by Claire Amiot in her thesis. The Auslander algebras of these categories, i.e., the endomorphism algebras of the direct sum of one isomorphic copy of each indecomposable object, are precisely the finite dimensional mesh

algebras, also called m-fold mesh algebras, which had been previously introduced by Erdmann-Skowronski. They are self-injective algebras which are Ω-periodic, where Ω is the Heller syzygy operator, and include as particular cases all (usual and generalized) preprojective algebras. In this talk, based on joint work with Estefania Andreu Juan,see [1], we will explicitly calculate the period of these algebras and will determine those algebras in the class whose stable category is Calabi-Yau in the sense of Kontsevich. In this latter case we will give the precise formula for the corresponding Calabi-Yau dimension. The formulas heavily depend on the associated Dynkin graph and its Coxeter number.

References

[1] Estefania Andreu Juan and Manuel Saorin. *The symmetry, period and Calabi-Yau dimension of finite dimensional mesh algebras* DOI:10.1016/j.algebra.2015.01.006

Filtrations in abelian categories determined by a tilting object

Dag Madsen

University of Nordland
Norway

A tilting object of projective dimension one in an abelian category determines a torsion pair and consequently every object has a two-step filtration. In joint work with Jensen and Su we discovered that a titling object of projective dimension two determines a triple of disjoint extension closed subcategories subcategories such that every object has a unique functorial filtration of length three. In this lecture, I will discuss the above result and the generalization due to Jason Lo: A titling object of projective dimension n determines $n+1$ disjoint extension closed subcategories such that every object has a unique functorial filtration of length $n+1$.

References

[1] Jensen, Bernt Tore, Madsen, Dag Oskar and Su, Xiuping. *Filtrations in abelian categories with a tilting object of homological dimension two.* J. Algebra Appl. **12** (2013), no. 2, 1250149, 15 pp

[2] Lo, Jason. *Torsion pairs and filtrations in abelian categories with tilting objets.* DOI: 10.1142/S0219498815501212

Transitive designs constructed from finite groups and related codes

Dean Crnković

Department of mathematics
University of Rijeka, Croatia

In this talk we describe a construction of 1-designs determined by a transitive action of a finite group. We apply this method to construct transitive designs from some finite simple groups. Some of the constructed 1-designs are also 2-designs. One can use this method to construct other combinatorial structures admitting transitive automorphism group, e.g. strongly regular graphs. Further, we discuss linear codes obtained from the constructed combinatorial structures and the corresponding orbit matrices.

Sabinin algebras

Jacob Mostovoy

Universidad Nacional Autonoma de Mexico
jacob.mostovoy@gmail.com

Sabinin algebras play the same role in the non-associative Lie theory as Lie algebras in the classical Lie theory. Geometrically, a Sabinin algebra can be interpreted as the structure on the tangent space to a manifold with a flat affine connection; it consists of an infinite number of operations which may be thought of as the covariant derivatives of the torsion tensor of the connection.

Similarly to Lie algebras, Sabinin algebras have universal enveloping algebras (in this case they are non-associative) and can be integrated. While in general the integration procedure produces only a formal non-associative product, there are interesting particular cases (such as Malcev algebras or nilpotent Sabinin algebras) when a Sabinin algebra integrates to a unique simply connected globally defined loop.

In a certain sense, Sabinin algebras are a relative version of Lie algebras and the techniques of the theory fall into the scope of the classical Lie theory. I will give an overview of the theory of Sabinin algebras and non-associative Lie theory in general. The following topics will be addressed

(1) Sabinin algebras and flat affine connections.
(2) Non-associative Hopf algebras and the integration.
(3) Particular cases: Malcev and Bol algebras, Lie triple systems, nilpotent Sabinin algebras.
(4) Applications to discrete loops.

TBA

Jonathan I. Hall

Department of Mathematics
Michigan State University
E. Lansing, MI 48824-1027

List of participants

Agostinho, Ilidio (Universidade Agostinho Neto, Angola, maria.denatividade@uam.es)

Ali, Faryad (Al-Imam Mohammad Ibn Saud Islamic University, Saudi Arabia, faryada@hotmail.com)

Attan, Sylvain (Benin, syltane2010@yahoo.fr)

Banda, Adson (University of Zambia, adson@aims.ac.za)

Bouesso, Andre (AIMS-South Africa,)

Chere, Nega (Pretoria, Nega.Chere@tuks.co.za)

Chikamai, Lucy (Kenya, lucychikamai@gmail.com)

Chileshe, Chrisper (North West University, chrisperc@aims-senegal.org)

Cox, Ben (College of Charleston, USA, coxbl@cofc.edu)

Crnkovic, Dean (Department of Mathematics, University of Rijeka, Croatia, deanc@math.uniri.hr)

Futorny, Vyacheslav (University of Sao Paulo, Brazil, vfutorny@gmail.com)

Gumede, Sfundo (University of South Africa, njojo9202@gmail.com)

Haddou, Malita (Morocco, maitbenha@gmail.com)

Hall, Jonathan (Michigan State University, USA, jhall@math.msu.edu)

Kashuba, Iryna (University of Sao Paulo, Brazil, ikashuba@gmail.com)

Key, Jennifer (University of the Western Cape, keyj@clemson.edu)

Madanha, Yasha (University of Pretoria, madanhasy@gmail.com)

Madsen, Dag (University of Nordland, Norway, dag.oskar.madsen@uin.no)

Magamba, Kondwani (University of Malawi, kondwanimagamba@gmail.com)

Maharaj, Rajeev (University of KwaZulu-Natal, Durban, maharajrajeev20@gmail.com)

Mahoungou, Clostone Francioli (AIMS-Senegal, mahoungou.f.clostone@aims-senegal.org)

Man Wa, Alice (University of KwaZulu-Natal, Durban, huimanwa@gmail.com)

Mathieu, Olivier (CNRS, University of Lyon, France, mathieu@math.univ-lyon1.fr)

Mba, Jules (University of Johannesburg, jmba@uj.ac.za)

Mbaale, Xavier (University of KwaZulu-Natal, Durban, xavier@aims.ac.za)

Mishra, Ashish (India, ashishm@math.iitb.ac.in)

Mkiva, Soga (North West University, Soga.Mkiva@nwu.ac.za)

Molev, Alexander (University of Sydney, Australia, alexander.molev@sydney.edu.au)

Monaledi, Ramotjaki (Military Mathematics, Stellenbosch University, amona@ma2.sun.ac.za)

Monsalve, Germán (University of Sao Paulo, Brazil, gabm03@gmail.com)

Moori, Jamshid (North West University, jamshid.moori@nwu.ac.za)

Mostovoy, Jacob (Center for Research and Advanced Studies of the National Polytechnic Institute, jacob.mostovoy@gmail.com)

Mpono, Eugene (University of South Africa, Mponoze@unisa.ac.za)

Mukhin, Evgeny (IUPUI, USA, mukhin@math.iupui.edu)

Mumba, Nephtale (University of the Western Cape, nephtale@aims.ac.za)

Mwambeni, Eric (University of the Western Cape, emwambene@uwc.ac.za)

Nasilele, Monde (University of KwaZulu-Natal, Durban, monde@aims.ac.za)

Ndoye, Daouda (AIMS-Senegal, daouda.ndoye@aims-senegal.org)

Nyaare, Benard (Kenya, bnyaare@yahoo.com)

Ogunfolu, Olusola (Nigeria, teminiyidele@gmail.com)

Perumal, Pragladan (Durban University of Technology, preggyp@dut.ac.za)

Prins, Abraham (Military Mathematics, Stellenbosch University, abraham.prins@ma2.sun.ac.za)

Ramirez, Luis (Sao Paulo, Brazil, luisenrique317@gmail.com)

Rodney, Philani (University of Zululand, majrod2003@yahoo.com)

Rodrigues, Bernardo (University of KwaZulu-Natal, Durban, rodrigues@ukzn.ac.za)

Rozhkovskaya, Natasha (Kansas State University, USA, rojkovsk@gmail.com)

Rukaria, Lydiah (Kenya, lydiahrukaria@gmail.com)

Saeidi, Amin (North West University, saeidi.amin@gmail.com)

Salita, Maindo (Universidade Agostinho Neto, Angola, maria.denatividade@uam.es)

Sambogo, Janeffer (Unisa, sambomj@unisa.ac.za)

Saorin, Manuel (University of Murcia, Spain, msaorinc@um.es)

Seretlo, Thekiso (North West University, Thekiso.Seretlo@nwu.ac.za)

Shestakov, Ivan (University of Sao Paulo, Brazil, ivan.shestakov@gmail.com)

Shumba, Tendai (University of KwaZulu-Natal, Durban, tendshumba@gmail.com)

Singh, Shivani (University of KwaZulu-Natal, Durban, shivstarsingh@gmail.com)

Tong-Viet, Hung (University of Pretoria, tvphihung@gmail.com)

Tung, Le (North West University, lttung96@gmail.com)

van den Berg, John (University of Pretoria, john.vandenberg@up.ac.za)

Zelule, Afikile (University of Fort Hare, zafikile@yahoo.com)