Nonlinear Dynamical Systems
La Trobe University
28–30 September 2012

The aim of the workshop was to bring together mathematicians from two areas of research for cross-fertilisation of ideas: researchers in nonlinear systems and integrable dynamics. We invited an excellent variety of keynote speakers in order to attract a range of participants from both schools of research.

Organising committee
- Professor Reinout Quispel (La Trobe University)
- Dr Christopher Ormerod (La Trobe University)
- Dr Sarah Lobb (La Trobe University)
- Dr Dmitry Demskoi (Charles Sturt University)
- Dr Peter van der Kamp (La Trobe University)

Topics covered
- Applications of nonlinear dynamical systems
- Stable and unstable manifolds
- Nonlinear wave equations
- Integrable dynamics
- Hamiltonian and bi-Hamiltonian systems

Special presenters

Dr James Atkinson (University of Sydney, Australia): Dr Atkinson has quickly established himself as an up-and-coming expert in the area of integrability of partial difference equations. He has remarkable insight into the beautiful geometric structures lying behind these systems.

Prof. Andy Hone (University of Kent, UK): Professor Hone has an encyclopedic knowledge of integrable systems. His work has made profound links between arithmetic geometry and integrability, and recently the new theory of cluster algebras.

Prof. Kenji Kajiwara (Kyushu University, Japan): Professor Kajiwara is an internationally renowned expert in integrable nonlinear ordinary and partial difference equations. He is one of the pioneers of the understanding of the group theory of discrete Painlevé equations.

Prof. Bernd Krauskopf (University of Auckland, New Zealand): Professor Krauskopf is an expert in nonlinear dynamical systems, and specialises in the theory of

chaotic dynamical systems. In collaboration with Professor Hinke Osinga, also a participant in this workshop, he has developed cutting-edge algorithmic techniques for computing unstable and stable manifolds.

Prof. Wolfgang Schief (University of New South Wales): Professor Schief is currently Head of the Applied Mathematics Department at the University of New South Wales, and a previous recipient of the prestigious Queen Elizabeth II Research Fellowship. He has done outstanding work on nonlinear wave equations and integrable systems.

Prof. Vladimir Sokolov (Landau Institute for Theoretical Physics, Russia): Professor Sokolov is a leading researcher in the Landau Institute for Theoretical Physics. He is a specialist in integrable 3-dimensional systems of hydrodynamical type and quantum integrable systems, and is a pioneer in the theory of matrix integrable systems.

Prof. Ferdinand Verhulst (Utrecht University, Netherlands): Professor Verhulst is a famous name in mathematics from the Netherlands. He became Professor of Dynamical Systems in 1990 and has founded a publishing company, Epsilon Uitgaven, which publishes books on science and mathematics. He has recently completed a biography of Henri Poincaré.

Report

Nonlinear dynamical systems are inherently interesting objects from both a theoretical and applied viewpoint. Nonlinear dynamical systems appear ubiquitously in natural phenomena; hence, they have applications to many facets of science including the biological, chemical and physical sciences. They are also of mathematical interest in themselves, as the theory incorporates notions from a broad range of mathematical disciplines, such as algebraic geometry, differential geometry, random matrix theory and representation theory.

Nonlinear dynamical systems admit a wide range of dynamical behaviours. From the applied to the abstract, from the chaotic to the solvable, this workshop aimed to facilitate a cross-fertilisation of the various ideas that have been developed across the areas.

This workshop showcased some of the most recent advances in research areas across this spectrum. From the keynote speakers we saw some novel applications of methods for calculating stable and unstable manifolds, the newest integrable discrete dynamical systems and their solutions, applications of nonlinear dynamical systems to differential geometry, and chaotic and integrable dynamics from Hamiltonian systems. The truly exceptional line-up of keynote speakers, aided by major funding from AMSI, AustMS and La Trobe University, was a key factor in the success of the workshop.

From our contributing speakers, we saw applications of nonlinear dynamical systems to mathematical physics, some of the newest methods from geometric integration, new interpretations of the very definition of integrability, advances in the

interplay between partial and ordinary difference and differential equations and systems that break the traditional rules of integrability and may or may not lend themselves to chaotic behavior. This broad range of topics from all speakers is testament to the success of the workshop.

An element of the workshop which proved to be immensely successful was the inclusion of special student talks, which were short talks more appropriate for honors or first year PhD students. The presentations were all excellent and a credit to the students. The talks also served the purpose of being a conversation starter for many of the students to talk to the experts.

One of the key successes of the workshop was to bring experts from around the globe to La Trobe to interact with up-and-coming researchers in the field. About one third of the participants were students and there were just about as many postdoctoral participants. As a result of this meeting, we saw free-flowing exchange of interesting ideas during the exchanges in the conference and in the tea breaks. This was continued outside the workshop, hence, the workshop also strengthened our ties with leading international researchers.

Organisers' opinion of success

We had a wonderfully successful line-up of keynote speakers, spanning the full range of nonlinear dynamical systems that we sought to represent. The keynote addresses were all of an excellent quality, and the special public lecture by Professor Ferdinand Verhulst was especially well received.

In terms of the aim of providing a platform for young researchers to engage with established researchers, we had great success. There were many interactions between students, early career researchers and the established experts in the field.

There was a good level of intermixing between people with interests in chaotic systems and those with interests in integrable systems, hence, regarding cross-fertilisation of ideas, there was some measure of success. This could have been improved further by a greater presence from those interested in chaotic systems.

There were aspects of the conference that could have been improved, namely the timing and the representation. The timing was difficult, as the one week in semester break is not uniformly placed across Australian universities. Holding the workshop on a Saturday was also a slight deterrent, as was the fact that it was the weekend of the AFL Grand Final. More people may have attended if we had chosen a time after semester. Secondly, there was a large representation of researchers primarily interested in integrability. While one cannot predict the precise mix of participants, perhaps a more even mix of keynote speakers would have made the workshop more attractive to non-integrable people. A few people needed to pull out at the last minute due to illness and family circumstances, which also had an effect on the balance of interests.

Appendix 1: Event feedback

While we did not formally ask participants to provide us with feedback, we did get some comments informally about the conference

- the student talks were fantastic
- the schedule and timings of the talks were good
- there could have been more people studying more chaotic nonlinear dynamical systems
- some of the talks were not aimed at a general enough audience.

On the more administrative side

- the accommodation on campus was great
- it can be difficult to get to La Trobe
- Melbourne was colder than people had expected
- catering was great.