

“Dynamics, Bifurcations and Numerics”

Workshop report

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Workshop aims

Dedicated to the memory of internationally recognised Surrey mathematician Dr Claudia Wulff, the aim of this workshop was to provide a platform for world-leading experts in PDEs (partial differential equations), hydrodynamics and numerical simulations to address key problems and new approaches inspired by Claudia's work.

The aim of the workshop was to bring together the topics of classical finite-dimensional dynamics with the analysis of infinite dimensional systems generated by PDEs, focusing on:

- Dynamical systems and bifurcation theory,
- Analysis of PDEs with applications to hydrodynamics,
- Numerical analysis and computation.



Event themes

The workshop attracted around 30 in-person and more than 60 online participants from all over the world and provided a platform for intensive discussions in the areas indicated by the workshop aims and in the related areas. One of the key themes to discuss was a fundamental question of the theory of dissipative systems, namely, the validity and nature of finite-dimensional reduction in such systems. The discussion was inspired by the subsequent talks of Edriss Titi (Cambridge) and Sergey Zelik (Surrey) in the first day and continued during the whole workshop. Although the modern theory offers a number of alternative ways to build up such a reduction, all of them have essential drawbacks and the relations between them and even their nature remain a mystery. This mystery prevents us from effectively using the reduction in applications, in particular from developing new numerical schemes based on such a reduction. The workshop attracted extra attention to this problem from the leading experts in the field of Dynamical Systems (Bernold Fiedler

(Germany), Jeroen Lamb, Dmitry Turaev (Imperial), Ian Melbourne (Warwick), Bjorn Sandstede (Brown University, USA)), Analysis of PDEs (Edriss Titi (Cambridge), Arnd Scheel (Minneapolis, USA)) and Numerical Analysis (Arieh Iserles (Cambridge)), etc. We expect that the initiated discussions will be continued in future and will shed some light on the above mentioned and related problems.

One more popular theme of the workshop is related to bifurcation theory with special attention to bifurcations with symmetries and applications to PDEs. This direction is close to the main areas of the scientific interests of Claudia Wulff and was presented in many talks of her scientific friends and coauthors (Jeroen Lamb and Dmitry Turaev (Imperial), David Chillingworth (Southampton), Bernold Fiedler (Germany), Bjorn Sandstede and Arnd Scheel (USA), etc.). The discussions in this area were especially intensive and fruitful and produced a belief that the key ideas originated in the works of Claudia do not lose their actuality and will be further developed/completed in the works of her successors.

The other theme of the workshop was related to Numerical Analysis, especially with inventing new high accuracy numerical schemes suitable for simulating both ODEs and PDEs. This area is also related with the scientific interests of Claudia and was presented by several prominent mathematicians (Arieh Iserles (Cambridge), Marcel Oliver (Germany), etc.). The survey talk of Anna Kostianko (Imperial) also raised questions on possible applications of inertial manifolds and other methods for the finite-dimensional reduction to problems related to numerical simulations of dissipative PDEs.

Summarising, we hope that the workshop gave a nice opportunity for the leading experts in the areas of Dynamical Systems, Analysis of PDEs and Numerical Analysis to meet together to discuss the key open problems, disseminate their results and share their experience with young mathematicians. We are also proud to note that the organized workshop made an essential contribution in advertising and disseminating the original works of Claudia Wulff to the mathematical community, which was one of the main sources of inspiration for the organizers.



Next steps - Outcomes

The main outcomes are:

1. A series of publicly available recordings of the contributed talks, hosted on the [Panopto website](#)
2. A conference proceedings, to appear in the LMS Lecture Notes Series



Feedback

Although there was no official feedback for this event, most participants thanked us for the event indicating the high level of organisation, its timelines and good choice of speakers. The typical comments were like this: *“I was glad to meet you at the conference last week. It was most enjoyable, despite the sad reasons for its existence. Thank you for organising it”*

Acknowledgements

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