Submittee: Ian Frigaard
Date Submitted: 2011-12-01 16:46
Title: Applied Mathematics Perspectives 2011
Event Type: Conference-Workshop

Location:
UBC (7 workshops) // University of Victoria (2 workshops) // BIRS (2 workshops)

Dates:
Various in July 2011

Topic:
At UBC: Advances in the numerical solution of constrained differential equations // Complex Fluids in Industry & Nature // Delay Differential Equations in Applications: Common Themes and Methods // Numerical methods for incompressible flow // Numerical Ricci Flow in Computer Science, Geometry, and Physics // Reproducible Research: Tools and Strategies for Scientific Computing // Seismic and medical imaging // At UVic: Mathematical Biology Workshop and IGTC Summit // Applied Analysis & Applied PDEs // At BIRS: Localized Pattern Formation* // Mathematical Challenges from Spatial Ecology: Environmental Variability* //

Methodology:
The format of the 7 UBC workshops were all similar. They each consisted of a single session of speakers on that theme. The workshops ran in parallel in close proximity to each other, with shared lunch and coffee breaks and receptions. There was a poster session joint between the workshops, attracting around 30 posters. One of the workshops ran a public forum downtown on the Saturday preceding ICIAM. The IGTC summit at University of Victoria contained a mix of lectures and research presentations, as it doubled as a graduate summer school in Math Biology. A poster session was also held. The second workshop at University of Victoria also contained an educational component. The two BIRS workshops followed a standard 5-day format.

Objectives Achieved:
AMP was a series of workshops selected to expose different facets of applied mathematics, interpreted broadly. The workshops were targeted at scientific advances in the different areas, but specifically targeted to occur in the weeks before and after ICIAM 2011, so as to enhance the attendance at ICIAM and allow for a deeper investigation into these selected areas.

Scientific Highlights:
In the workshop, "Advances in the Numerical Solution of Constrained Differential Equations", 20 speakers from 10 different countries gave lively and informative talks on their recent research in theory, computation, and software for solving differential equations subject to constraints. Applications included multi-body systems with collisions, virtual reality, robotics, image reconstruction, and data inversion in geophysics. Many also gave personal accounts of how their

careers were influenced by their interactions with Uri Ascher, whose 65th birthday was the focal point of this workshop. // In the workshop on "Reproducible Research" we heard 14 talks on tools and techniques for improving reproducibility in the computational and data sciences, ranging from virtual machines to data provenance to executable papers to intellectual property issues; all of the talks were video recorded and are available at "http://tinyurl.com/3c3gxwn". The two main days of the workshop were preceded and succeeded by half-day tutorial sessions for students and junior participants on a variety of tools. We have arranged for a special issue on reproducible research in the IEEE / AIP journal Computing in Science and Engineering, with an expected publication date in July 2012. // In "Applied Analysis and Applied PDEs", Three mini-courses were given by leading specialists in the topics of optimal transportation theory, Navier-Stokes-type equations, and PDEs and waves for the atmosphere and ocean. Not only did the mini-courses educate graduate students and postdocs on the numerous tools used in these fields, but they also helped other researchers to make new connections with their research areas, and find new techniques to use in them. Therefore, several new lines of inquiry arose from connections between researchers of the different focus areas. All this was enhanced by the talks on the most recent results obtained in each of the above topics. // The 2011 Amp workshop on "Medical and Seismic imaging" brought together researchers and practitioners in academia and industry to discuss advances in mathematical methods used to produce reliable, accurate, and useful images for both medical and geophysical applications. Attendees included geophysicists from as far as Shell Oil in the Netherlands, to medical scientists from England and Oregon, to mathematicians from MIT, Rochester, Corvalis, and across Canada. The central topic of the workshop is the mathematical and computational methods that form a common base for these imaging applications. A notable discovery was the wide commonality of state-of-the-art mathematical methods that can be used equally effectively in diverse imaging application: from CAT scans in medicine to deconvolution/migration in seismic imaging, to radar imaging in military environments. The computational challenges revealed are significant, and sharing experiences in applying appropriate large computing technologies in both industry and at universities was particularly valuable. // In the workshop on "Complex Fluids and Flows in Industry and Nature", about 50 scientists with interests in a variety of mathematical problems in fluid mechanics convened at UBC. The participants presented lively talks and entertained discussions on problems with origins in the engineering, physical and biological sciences. The forum offered a unique opportunity to foster collaborations and transfer mathematical technology between a number of different disciplines. // In the "Numerical Methods for Incompressible Fluid Flow" workshop, the focus was on the dissemination and discussion of some new results in the development and analysis of numerical algorithms for fluid flow problems. The scientific highlights have been talks on the exact imposition of incompressibilit, new stabilization techniques based on entropy inequalities, fast and massively parallelizable algorithms, and new exciting families of discrete spaces based on B-splines. In addition, several talks identified key areas of applications, in which these algorithms are of great importance and which require serious further development. The most important are: atmospheric and ocean flows, as well as biological and pharmaceutical applications. // In the "AMP Mathematical Biology Workshop and IGTC summit" held at the University of Victoria, speakers included leading international researchers and graduate students in mathematical biology with a focus on gene and neural networks, and structured population dynamics. Eighteen talks, a poster session, and an education session on how to develop interdisciplinary research collaboration allowed for lively discussion and exchange of ideas.

Organizers:

Local Organising Committee: I. Frigaard (University of British Columbia), T. Hillen (University of Alberta), B. Khouider (University of Victoria), M. Lamoureux (University of Calgary), R. LeVeque (University of Washington), N. Nigam (Simon Fraser University), R. Russell (Simon Fraser University), R. Spiteri (University of Saskatchewan), M. Ward (University of British Columbia) //

Scientific Committee: R. Craster (Imperial College, UK), M. Davidson (University of Western Ontario), I. Frigaard (University of British Columbia), G. Homsy (University of British Columbia), S. Howison (Oxford University, UK), H. Othmer (University of Minnesota, US), M. Overton (Courant Institute, US), O. Scherzer (Vienna, Austria), R. Spiteri (University of Saskatchewan) // Workshops held at UBC: R. Spiteri (Saskatchewan), C. Greif (UBC), N. Balmforth (UBC), I. Frigaard (UBC), G. Homsy (UBC), S. Campbell (Waterloo), T. Humphries (McGill), B. Krauskopf (Bristol), J. Sieber (Portsmouth), P. Minev (Alberta), D. Schoetzau (UBC), C. Doran (Alberta), S. Vardarajan (Alberta), D. Gu (SUNY), B. Gulliver (Minnesota), R. LeVeque, (U. Washington), I. Mitchell, (UBC), C. Moler, (Mathworks Inc.), V. Stodden (Yale), P. Binding (Calgary), M. Lamoureux (Calgary), G. Margrave, (Calgary) // Workshops held at University of Victoria: R. Edwards, J. Ma & P. van den Driessche (Victoria), L. Allen (Texas TU), M. Mackey (McGill), S. Levin (Princeton). M. Agueh (Victoria), S. Ibrahim (Victoria), S. Stechmann (UCLA) // Workshops held at BIRS: M. Ward (UBC), E. Knobloch (Berkeley), A. Doelman (Amsterdam), Y. Nishiura (Hokkaido), B. Deconinck (U. Washington), S. Cantrell (Miami), C. Cosner (Miami), M. Lewis (Alberta), R. Holt (Florida)

Speakers:
Approximately 220 speakers took part. The names and abstracts are in the workshop manuals available at the website: http://www.mitacs.ca/goto/amp2011 or directly from PIMS. 4 of these are uploaded

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Links:
http://www.mitacs.ca/goto/amp2011

File Uploads:
Additional Upload 1:
http://www.pims.math.ca/files/final_report/AMP_manual_-_Complex_Fluids_And_Flows.pdf
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