SIAM UK and Republic of Ireland section annual meeting 2008

The UK and Republic of Ireland section of SIAM held its 12th annual meeting on January 4th 2008 at Southampton University. Despite the inclement weather, and some untimely problems on the rail network, nearly forty mathematicians from across the UK and Republic of Ireland attended, with participants travelling from as far afield as Cork and Glasgow. Membership of the section continues to grow, currently standing at 370 (compared to 187 members when founded in 1996 and 350 last year).

Roland Keunings (Université Catholique de Louvain) opened the meeting with an illuminating talk on the challenges of multiscale modelling of complex fluids, focusing in particular on micro-macro numerical techniques for predicting complex flows of viscoelastic fluids. The micro-macro approach couples the mesoscopic scale of kinetic theory to the macroscopic scale of continuum mechanics. A numerical solution is sought to the coupled non-linear problem involving the conservation laws and a microstructural model of kinetic theory. Although micro-macro techniques are much more demanding in terms of computer resources than conventional continuum computations, they allow the direct use of kinetic theory models in flow simulations, thus avoiding potentially inaccurate closure approximations.

Celia Glass (Cass Business School, City University) was the next speaker, with a talk on discrete algorithms for industrial applications. First, problems arising in call centres were considered; sufficient staffing levels are crucial to their smooth running, but staff costs represent 75% of operating costs. A mathematical challenge is to provide an alternative to the current widely used mass production model that can match staffing levels to the required workload whilst including constraints on "staff-friendly" shift patterns. Next, a problem of alleviating bottlenecks in a micro-biology laboratory was discussed. The mathematical problem here boiled down to one of production scheduling; by efficiently coordinating processes it was demonstrated that significant increases in throughput could be achieved with no increase in costs.

The business meeting followed. After a brief report on the finances and activities funded in the last year, the members were reminded that the post of section secretary / treasurer becomes vacant at the end of March 2008, and nominations were solicited. At the time of writing an election is taking place between Sue Dollar (Rutherford Appleton Laboratory) and Rob Scheichl

(University of Bath). A short discussion on the role of the section followed. It was widely agreed that the annual meeting was an excellent activity which should continue into the future, with agreement that the first or second Friday in January was the optimum date.

After lunch, Christine De Mol (Université Libre de Bruxelles) continued with a talk on sparsity and regularization. An overview was given of the role of sparsity in the solution of several imaging and regression problems arising from various applications. The problem is formulated as the minimization of a least-squares discrepancy with a sparsity-enforcing penalty, such as the L^1-norm of the sequence of coefficients of the searched-for solution on a given basis or frame. For inverse problems, such penalties are shown to stabilize the solution of the problem in the same way as the standard quadratic penalties used e.g. in Tikhonov's regularization method. Several iterative algorithms which can be used to compute such sparse solutions were also analyzed and compared.

Chris Farmer (Schlumberger Abingdon Technology Centre) then spoke about sequential algorithms for inverse problems arising in applications such as oil reservoir management and weather forecasting, where the data is usually insufficient in quantity to determine either the coefficients (usually functions) of the mathematical model or the initial conditions. This difficulty can be resolved using a statistical framework that integrates prior information about the unknowns, the system model, models of the measuring instruments and the values of the measurements. The way in which different approaches to inverse problems can be unified by a statistical framework and how Monte-Carlo methods can be practical if the measurements are assimilated in a sequential fashion was outlined. In particular, the relationship between an exact Bayesian filtering solution of an inverse problem and approximation methods such as the Ensemble Kalman Filter was discussed.

After a short break, Peter Jimack (University of Leeds) continued with a talk on finite element modelling of three-dimensional visco-elastic polymer flows. By considering non-Newtonian flow, extra stress terms appear in models of incompressible fluid flow, due to polymer deformation, leading to large systems of coupled PDEs. Professor Jimack described how these can be discretised using a Galerkin finite element method for the momentum equations and a Petrov-Galerkin finite element scheme for the polymer equations. Numerous computational results were presented, all achieved on a laptop computer, and comparisons with other computational and experimental results were discussed.

John King (University of Nottingham) concluded the meeting with a talk on population-scale modelling of cellular aggregation and chemotaxis. Models for growing tissue from cells consist of a combination of random motion, diffusion and chemotaxis, essentially competition between dispersal and aggregation. As cells redistribute to form tissue, two scales are required, reflecting the tendency of cells to grab together and aggregate as opposed to their tendency to diffuse and spread out. The resulting systems are integrable in certain special cases, but for the more general case it was shown how asymptotic solutions can be derived.

Information about the UKIE section can be accessed from links at `http://www.siam.org/sectchapts/sections.htm`. *The next annual meeting will take place on January 9th 2009 at the University of Limerick.*