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SIAM's UK/Republic of Ireland Section Holds 12th Annual Meeting

The UK and Republic of Ireland Section of SIAM held its 12th annual meeting on January 4, 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, some travelling from as far afield as Cork and Glasgow. The section continues to grow, with membership currently standing at 370 (compared with 187 members on the section's founding, 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. The aim is a numerical solution to the coupled nonlinear problem involving the conservation laws and a microstructural model of kinetic theory. Although much more demanding in terms of computer resources than conventional continuum computations, micro–macro techniques allow the direct use of kinetic theory models in flow simulations, thus avoiding potentially inaccurate closure approximations.

Celia Glass (Cass Business School, City University) followed with a talk on discrete algorithms for industrial applications. She began by considering problems that arise in call centres, in which sufficient staffing levels are crucial to smooth operation and in which staff costs represent about 75% of operating costs. A mathematical challenge is to provide an alternative to the current widely used mass production model—one that can match staffing levels to the required workload whilst including constraints on "staff-friendly" shift patterns. Glass then turned to the problem of alleviating bottlenecks in a microbiology laboratory. The mathematical problem here boils down to one of production scheduling; with efficient coordination of processes, she demonstrated that significant increases in throughput can be achieved with no increase in costs.

The section's business meeting included a short discussion of the role of the section. It was widely agreed that the annual meeting is an excellent activity that should be continued, with the first or second Friday in January identified as the optimal date.

Christine De Mol (Université Libre de Bruxelles) continued the technical programme with a talk on sparsity and regularisation. In an overview, she described the role of sparsity in the solution of several imaging and regression problems arising from various applications. The problem is formulated as the minimisation 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 stabilise the solution of the problem in the same way as the standard quadratic penalties used in, for example, Tikhonov's regularisation method. De Mol also analysed and compared several iterative algorithms that can be used to compute such sparse solutions.

Chris Farmer (Schlumberger Abingdon Technology Centre) discussed sequential algorithms for inverse problems arising in various applications, including oil reservoir management and weather forecasting. In these settings the data is usually not available in sufficient quantities to allow determination of either the coefficients (usually functions) of the mathematical model or the initial conditions. This difficulty can be resolved by 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. Farmer outlined the way in which different approaches to inverse problems can be unified by a statistical framework and explained how Monte Carlo methods can be practical if the measurements are assimilated in a sequential fashion. In particular, he discussed the relation between an exact Bayesian filtering solution of an inverse problem and solutions obtained via approximation methods like the ensemble Kalman filter.

After a short break, Peter Jimack (University of Leeds) continued with a talk on finite element modelling of three-dimensional viscoelastic polymer flows. When the flows considered are non-Newtonian, extra stress terms appear in models of incompressible fluid flow because of polymer deformation, leading to large systems of coupled partial differential equations. Jimack discussed discretisation of these systems, with a Galerkin finite element method for the momentum equations and a Petrov–Galerkin finite element scheme for the polymer equations. After presenting numerous computational results, all achieved on a laptop computer, he drew comparisons with other computational and experimental results.

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 describe a combination of random motion, diffusion, and chemotaxis, essentially a competition between dispersal and aggregation. As cells redistribute to form tissue, two scales are required, reflecting the opposing tendencies of cells to stick together and aggregate and to diffuse and spread out. The resulting systems are integrable in certain special cases, but King showed how asymptotic solutions can be derived for the more general case.

Information about the UKIE section can be accessed from links at http://www.siam.org/join/sections/index.php. The next annual meeting will be held January 9, 2009, at the University of Limerick.—*Stephen Langdon, Secretary/Treasurer, UK and Republic of Ireland Section of SIAM.*