SIAM UK and Republic of Ireland section annual meeting 2007

The UK and Republic of Ireland section of SIAM held its 11th annual meeting on January 5th 2007 at the Oxford University Computing Laboratory. This was the first time the annual meeting had been held in Oxford, and the attendance was the largest it had been for some years with over a hundred registered participants including an encouraging number of postgraduate students, a sizeable industrial contingent, and visitors from as far afield as Calais, Paris, Stanford and Hong Kong. Indeed the section is going from strength to strength with its membership having expanded from 187 when founded in 1996 to 350 today.

Linda Cummings (Nottingham) opened the meeting with a talk on the mathematical modelling of lipid raft formation. Lipid rafts are lipid/protein microdomain structures, enriched in cholesterol and sphingomyelin, that are observed within eukaryotic cell membranes. As (essentially) phase-separated regions within the cell membrane it is thought that rafts can recruit certain reactants (e.g. proteins) and prevent their interaction with other reactants in the rest of the membrane, or conversely, bring desired reactants into close proximity, thus promoting certain reactions. Moreover, rafts are implicated in the mechanism of virus entry into cells, and in many cell-signalling processes. In this talk, the simplest model system of a bilayer composed of cholesterol and phosphatidylcholine was considered. A mathematical model for the raft formation was proposed, based on considerations of the interactions and bond formations between individual cholesterol molecules, and a comparison of the mathematical model with the experimental data revealed very good agreement.

Cleve Moler (Mathworks Inc) was the next speaker, and he gave a fascinating talk on the evolution of Matlab, showing how it has evolved over the last 25 years from a simple matrix calculator to a powerful technical computing environment. Several examples of MATLAB applications were demonstrated, including a particularly interesting analysis of how humans walk. The talk was concluded with some comments about future developments, including Parallel MATLAB.

The business meeting followed. After a brief report on the finances and activities funded in the last year, the members were reminded that the posts of section president and vice-president become vacant at the end of March 2006, and nominations were solicited. A short discussion of the role of the

section followed, at which it was widely agreed that the annual meeting was an excellent activity which should continue into the future. It was further agreed that the section should fund student prizes at the British Applied Mathematics Conference (to be held in Bristol, April 17th-19th 2007) and at the Dundee Numerical Analysis Conference (to be held in Dundee, June 26th-29th 2007).

After lunch, Jon Chapman (Oxford) continued with a talk on the interaction between discrete and continuum models. In many cases in which large numbers of discrete objects are interacting, a continuum model can be formulated, in which the discrete objects are replaced by a density (or probability distribution function). The relationship between these discrete and continuous models was considered, focussing in particular on regions where the continuous model breaks down, and needs to be matched with a discrete local approximation. Examples were drawn from the theory of dislocations, superconductivity, and molecular reaction-diffusion.
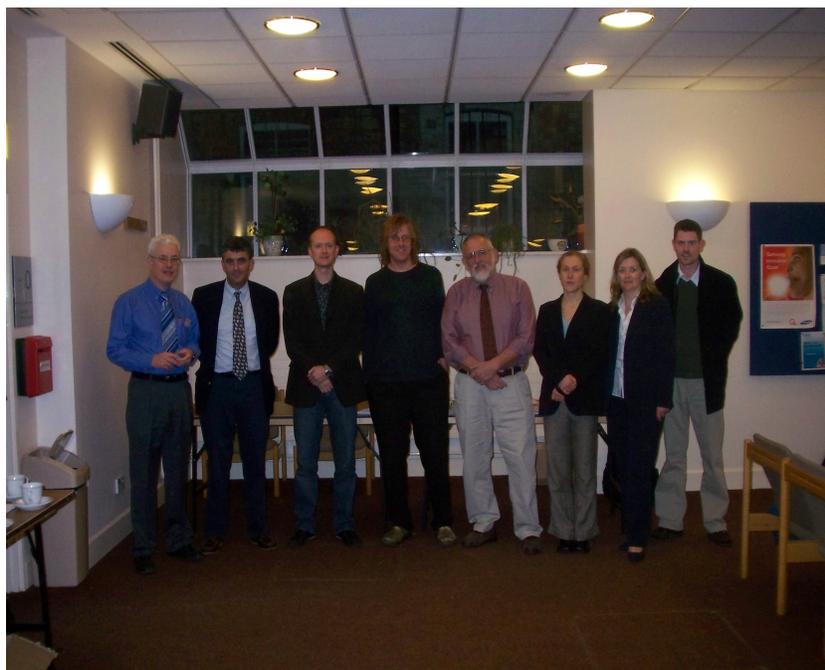
Andy Woods (Cambridge) then spoke about modelling heat and air flow in buildings, a subject with huge implications in energy efficient design. Some examples of zero energy buildings were introduced, with the main idea being that nature (i.e. gravity and wind) can be used to cool a building at night in such a way that there is no need to use air conditioning during the day. This natural ventilation leads to nonlinear convection with multiple states, and complex time dependence, with many challenges arising in describing the detailed flow regimes for ensuring effective means of ventilating buildings and managing the thermal environment.

After a short coffee break, Alison Ramage (Strathclyde) continued with a talk on the multigrid solution of discrete convection-diffusion equations. As well as being of interest in their own right, convection-diffusion problems are closely linked to the Navier-Stokes equations governing incompressible fluid flow which are widely applicable in industrial settings. One possible approach for their numerical solution is to use a multigrid method, either alone or as preconditioner to an iterative solver. In her talk, Alison presented a matrix-based Fourier analysis of multigrid convergence factors for a two-dimensional model convection-diffusion equation. The technique was demonstrated using a semiperiodic model problem, and it was shown that these results are strongly correlated with the properties of the iteration matrix arising from (more practically relevant) Dirichlet problems.

Andrew Stuart (Warwick) concluded proceedings with a talk on Monte Carlo Markov chains in high dimensions, an effective and flexible tool for sam-

pling a wide variety of complex probability distributions. Proposal distributions based on simple random walks, and on discretizations of the Langevin equation were introduced, and ideas from numerical analysis were used to construct improved samplers. These ideas were illustrated with application to the sampling of conditioned diffusion processes, an applied field in which the ideas presented have significant practical impact.

An enjoyable meeting was rounded off with an excellent dinner at Balliol College, subsidized by The MathWorks and Oxford Scientific Consulting. After an entertaining after dinner speech by Alistair Fitt (Southampton), the evening was concluded with the surprise appearance of a traditional Scottish piper to serenade Ian Duff on the occasion of his birthday.

Left to right: Nick Trefethen (President of UKIE section), Andy Woods, Jon Chapman, Andrew Stuart, Cleve Moler, Linda Cummings, Alison Ramage, Steve Langdon (Secretary/Treasurer of UKIE section)
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 4th 2007.*