

Foreword

Dr Philip McCrea, CEO ac3

This is the first edition of *ac3 news*, providing an update on what is happening at ac3. This edition focuses on some of the more applied R&D projects being undertaken by ac3's university partners, using our state-of-the-art high performance computers.

Established late in 2000, ac3's shareholders include the NSW Government, and 8 NSW-based Universities. During the last year ac3 has earned an international reputation for innovative research in High Performance Computing and visualisation.

We have established two Centres of Expertise – one in Visualisation in cooperation with VisLab, and the other in Computational Finance in cooperation with the new CRC for Capital Markets.

ac3's commercial clients are also benefiting from having ready access to High Performance Computing. We have also recently introduced a range of facilities managements services in the co-location and business continuity areas.

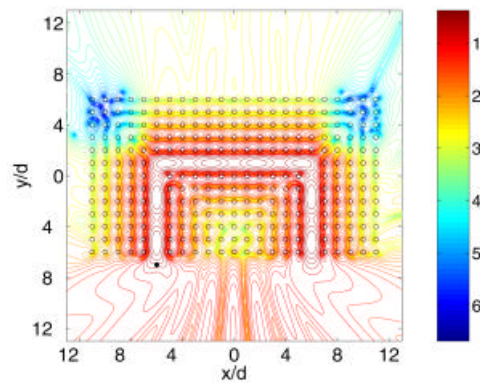


For more information contact me on (02) 9209 4601, or pmc@ac3.com.au, or stop by our office in the Australian Technology Park for a chat.

LIGHTING UP NETWORKS

Soon after Bell invented the telephone more than 120 years ago, he discovered that light could carry a person's voice. Known as the "photo phone", Bell used vibrating mirrors to transmit sound via sunlight. However, at the time, copper wire was more reliable, so the power of light as a means of transmission faded into the background.

Light communication was rediscovered in the 1970s with the invention of the laser and the optical fibre, giving rise to the age of Photonics. Today, telecommunications networks have incorporated Photonics technology, using optical fibres to carry telephony traffic across the globe.



Dielectric rods creating a Photonic band gap, bending light in its tracks

The concern with current optical fibre is that existing resources will eventually be unable to cope with the ever-expanding use of high bandwidth applications.

Research teams around the world, including the University of Technology, Sydney and the University of Sydney, are working on simulating optical switching devices that will result in the eventual development of optical integrated circuits. Applying switching technology known as Photonic band gaps, the University research seeks to manipulate photons (particles of light) to enhance the efficiency of optical devices as a transmission mechanism.

The research aims to improve the carrying capacity of light used in conventional optical fibres where light is confined inside the fibre by a "core" of treated or doped glass. During transmission over distance, the light suffers from impurities, fading the signal and lessening performance. To rectify this, the light is amplified at points along the fibre. However this amplification process is expensive.

(cont overleaf)

Research Profiles

Chartering Nature's Course: High-Resolution Meteorology

Inclement weather can have drastic consequences. Just think back to the severe and unexpected hailstorms that struck Sydney in April 1999 and their billion-dollar aftermath.

Professor Lance Leslie at the University of New South Wales is leading efforts toward the development of a next generation numerical weather prediction model, which will take some of the guesswork out of weather forecasting.

"This new weather model is a major step toward more accurate weather forecasts," Professor Leslie said. "It will give us a much clearer picture on local weather events unresolved by current models."

The new model will enable forecasts at significantly finer resolutions — with precision being improved from a 15 to 5 kilometre radius."

"A few kilometres may not seem that much — but in weather terms it is highly significant. For instance, the storms which devastated Paris and other areas of France late 1999 had cores too small to permit their prediction by current models," he said.

Professor Leslie will develop algorithms for weather prediction models on ac3 computers as part of the international effort to improve our ability to predict severe weather events

Improving the efficiency of coal-fired power stations

Australia relies on coal-fired power stations for over 80 per cent of its electrical energy.

Doctor Karina Sendt and Professor Brian Haynes of the University of Sydney have teamed up to study the oxidation of carbon, with the view to understanding carbon reactivity.

"As a result of studying carbon reactivity, Professor Haynes and myself hope to find ways for improving the efficiency of coal-fired power stations," Doctor Sendt said.

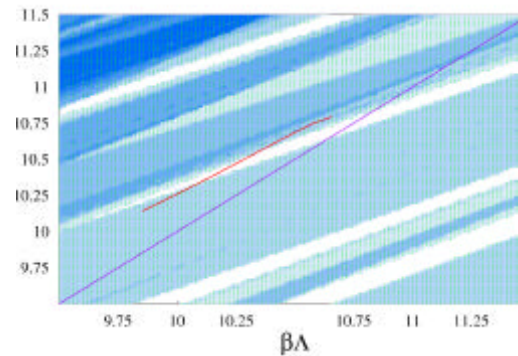
"Conducting this research will also assist us in understanding the reactions of biomass — another practical method of reducing greenhouse emissions."

Biomass is plant material, such as trees or wood waste, which can be converted into electricity or fuel. As a stored solar energy, biomass is viewed by many as having unprecedented potential as a renewable energy.

The research team will use ac3 computers as part of their prediction for the behaviour of surface oxides, as the information is not easy obtainable by traditional experimental means.

(Lighting up Networks, from page 1)

Photonic band gaps, or glass crystal fibre developments aim to form a structure, similar to honeycomb, whereby holes act as barriers, impassable to light. The holes are designed so that light can travel through the air without scattering.



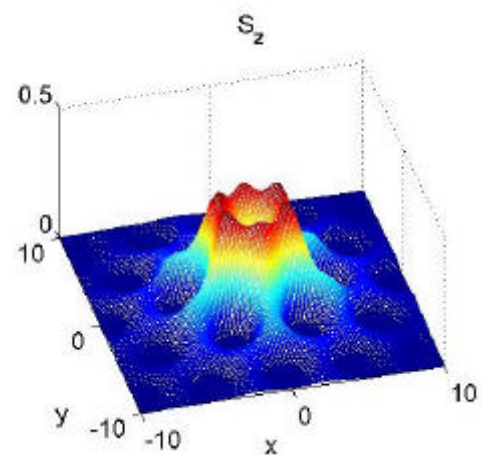
Dispersion curve for a Photonic crystal fibre

Dielectric materials (like glass, and with insulating properties) have also been tested to create a Photonic band gap, acting as mirrors for perfect reflection of light.

The UTS-University of Sydney Photonics research has resulted in the development of methods of unprecedented accuracy for the study of photonic crystal fibres or microstructured optical fibres (MOFs). These methods are being tested on ac3's high performance computing facilities.

It is anticipated these designs will lead to new commercial products manufactured in Sydney for local and world markets.

The research team comprises Prof LC Botten (UTS), Prof RC McPhedran, Prof PA Robinson, Dr CM de Sterke (Sydney).



Energy flow in optical fibre