

ARC Centres of Excellence Program

ARC Centre of Excellence for Mathematical and Statistical Modelling of Complex Systems

Interim Director: Professor A J Guttmann

Collaborating Institutions: The University of Melbourne
The Australian National University
The University of New South Wales
La Trobe University
The University of Queensland

Complex systems play an integral role in providing society with amenities such as the internet, air traffic control, irrigation systems, robotics, electrical power and telecommunications grids, defence and security systems, and manufacturing services and financial infrastructure. They also provide models for biological and economic systems of all types. Complex systems are characterised by the property of ‘emergence’, where the system considered as a whole displays properties that are not displayed by the component parts – ‘the whole is greater than the sum of the parts’.

It is of pivotal interest to society to have a greater understanding of complex systems, and ability to model and predict their behaviour. The Centre will assemble a very strong team to investigate mathematical and statistical models of complex systems, and to cross-fertilize these investigations with systems analysis and control theory.

The Centre will conduct research on criticality and phase change (e.g. in control of traffic queuing, and understanding catastrophic failure), Monte Carlo methods (e.g. in modelling financial systems), statistical modelling (e.g. in understanding telephone and internet traffic), dynamic systems (e.g. in meteorology, oceanography, and the behaviour of polymers and composite materials), risk modelling (e.g. in insurance, national security and health interventions), and advanced computation (e.g. to speed industrial design and to predict large-scale, long-term environmental impacts).

Mathematic and statistics lie at the centre of thought and reasoning in science, social science, engineering and technology. The Centre will lead research not only in complex systems, but will reinforce the importance of mathematics and statistics across the spectrum of Australia’s scientific and technological development. To achieve this, the Centre will maintain an extensive and vigorous outreach program, encompassing schools, commerce and industry, and the broader research community in Australia.