Hierarchical aggregation procedures for complex systems

R.S. MacKay

Mathematical Interdisciplinary Research and Centre for Complexity Science
Mathematics Institute, University of Warwick, UK

Given a description of a complex system at the level of individual units ("microscopic") and their interactions it can be fruitful to partition the system into groups of units which can be considered to be "super-units" with effective interactions between them. This aggregation procedure could in some cases be iterated to produce a hierarchy of levels of description.

Potential outcomes are:

- efficient ways to compute quantities for complex systems
- insight into the macroscopic behaviour
- Contexts in which some results will be presented include:
- equilibrium statistical mechanics
- shortest paths in graphs
- selfish traffic flow
- Markov processes
- multi-agent games
- oscillator networks