|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Session title: | Introduction to Monte Carlo methods | | | | Course: MC2001 | |
| Aims: | Introduce the concept of Monte Carlo (MC) modelling  Put them in a historical context  Use practical examples to explore the behaviour of a 2D Ising model | | | | | |
| Intended learning outcomes (ILOs) : | | | 1. Define MC methodology 2. Describe Metropolis Algorithm 3. Describe the concept of detailed balance 4. Illustrate the stochastic nature of MC methods using a practical example 5. Apply MC methodology to understand ferromagnetism in materials | | | |
| Assumed knowledge? | | | Basic thermodynamics – Boltzmann distribution, phase transitions  Simple grasp of integration  Classical potential modelling from previous session | | | |
| Timings / min | | ILO | Teacher activity | Learner activity | | Resources | |
| 0-15 | | 1, 3 | Lecture on MC methodology. | Listen. | | Powerpoint slides:   * MC methodology * comparison with MD * history * motivation for use | |
| 15-45 | | 3, 4 | Provide guidance on practical tutorial, either on an individual or group basis, as appropriate. | Work through practical exercise: follow the tasks, comprehend instructions, reflect on instructions, obtain and analyse results. Reflect on meaning of results. | | Self-contained tutorial on the Ising model, either as a Jupyter notebook or a pdf/html document. Will need input files and scripts. Simple answer sheet/guide for demonstrators. | |
| 45-60 | | 2 | Lecture on Metropolis algorithm and detailed balance. | Listen. | | Powerpoint slides:   * Metropolis procedure * concept of detailed balance * Links to thermodynamics | |
| 60-120 | | 3, 4 | Provide guidance on practical tutorial, either on an individual or group basis, as appropriate. | Work through practical exercise: follow the tasks, comprehend instructions, reflect on instructions, obtain and analyse results. Reflect on meaning of results. | | Self-contained tutorial on the Ising model, either as a Jupyter notebook or a pdf/html document. Will need input files and scripts. Simple answer sheet/guide for demonstrators. | |