Case studies in omniparametric simulation

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Abstract

In the field of particle systems and growths models simulation is an important tool when explicit calculations are too complex or impossible to perform. We adapt a new technique called omniparametric simulation to the two-type Richardson, Ising and Potts models.

We study asymmetric simultaneous survival for the two-type Richardson model using omniparametric simulations. The belief is that if both types are equally strong they can survive for all times but if one type is stronger this can not happen. We do not find any indication of the existence of simultaneous survival in the asymmetric case. A simple test procedure is developed to see how strong the indications against exceptional behaviour are.

For the Ising and Potts models we use omniparametric simulations to find smooth estimates of functions for model characteristics such as connection probabilities and susceptbility. These characteristics are then used for parameter estimation, both point estimates and confidence intervals. Based on partial observations we develop three methods, two using asymptotic theory, and on non-asymptotic, where the main difference lies in how we capture the variance of a statistic.

Keywords: growth model, Ising model, Markov chain, omnithermal simulation, omniparametric simulation, percolation, Potts model, parameter estimation, partial observations, random cluster model, Richardson model, simulation driven parameter estimation, two-type Richardson model

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