Monte Carlo simulations and field transformation: the scalar case

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Abstract

We describe a new method to compute, by stochastic simulations, observables at various values of the parameters λ_i in the lattice action $S(\phi, \lambda_i)$. Fixed a reference set of parameters λ_i^r, we perform a single simulation according to a "reference action" $S(\phi^r, \lambda_i^r)$ to generate configurations of the field ϕ^r. Then we perform a suitable analytic transformation from the ϕ^r-configurations to the ones corresponding to the action $S(\phi, \lambda_i)$. Such a transformation allows us to obtain the values of the observables at λ_i close to λ_i^r. We present studies on the reliability of the algorithm in the case of the simplest renormalizable model: the ϕ^4 scalar theory on a four dimensional lattice.