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Study of the dynamic behavior of Niedermayer's algorithm[1]
DANIEL GIRARDI, NILTON BRANCO, Universidade Federal de Santa Catarina, Departamento de Fisica — We calculate the dynamic exponent for the Niedermayer algorithm applied to the two-dimensional Ising and XY models, for various values of the free parameter E_0. For $E_0 = -1$ we reobtain the Metropolis algorithm and for $E_0 = 1$ we regain the Wolff algorithm. For $-1 < E_0 < 1$, we show that the mean size of the islands of (possibly) turned spins initially grows with the linear size of the lattice, L, but eventually saturates at a given lattice size $\widetilde{L}$, which depends on E_0. For $L > \widetilde{L}$, the Niedermayer algorithm is equivalent to the Metropolis one, i.e, they have the same dynamic exponent. For a given size L, the correlation time is always greater for the Niedermayer algorithm than for Wolff's. For $E_0 > 1$, the mean size of the islands of turned spins grows faster than a power of L and the correlation time is always greater than for the Wolff algorithm. Therefore, we show that the best choice of cluster algorithm is the Wolff one, when compared to the Nierdermayer generalization. We also obtain the dynamic behavior of the Wolff algorithm: although not conclusive, we propose a scaling law for the dependence of the correlation time on L.

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