Scalling Algorithm of the Parallel Execution for Numerical Simulation of a Magnetic Dipoles System

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Abstract: The parallel algorithm for numerical simulation of the system interacting magnetic dipoles and for the calculation it's behavior in an external field is considered. The proposed model allows calculate the profiles of the ideal magnetization for the system of fine particles with one-axes anisotropy. The scaling of the system over a particles number is possible at the expense of used energy drop scheme.

It is knowing that the simulation of a magnetic particles system with long-range interaction presents a complicated task, the solution of which one demands a huge computer resources. It concerns both the memory stack (heap reserved memory) for a saving of an information about the array of dipoles (coordinates, magnetic moments, summary components of interaction fields, volumes, etc.) and a compute-intensive calculation, because the total number of interactions in the system is growth up as $\frac{N^2}{2}(N-1)$. The physical restriction on the operative memory is 1 GB on the single computer core. It is possible to use virtual disk with calculated distribution of the interaction fields and other parameters of the magnetic nanosystem to enhance of number of particles. The long-range magnetostatic interaction between 10^6 particles (all—to—all) gives 10^{18} relations, which ones could be calculated exclusively parallel computing methods.

The program model allows a sedimentation of magnetic particles in an external magnetic fields, a consolidation of sediment, the calculation of interaction field distribution. The program package will be interested for research in area physics of rocks magnetism, physics interacting nanoparticles system.

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