Title

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The elastic regime of three-dimensional arrays of spherical magnets is studied. Three different crystal structures were built experimentally, then torsional and bending forces were applied to obtain a linear deformation until they collapse. The torsion and bending stiffness are determined experimentally and compared with numerical simulations based on energy minimization at each step of the acting stress. We found that these properties have a power low dependence on the geometry and it changes dramatically for each type of lattice.

Arrays of permanent neodymium spherical magnets are particular self assembled structures whose stability depend on the dipole orientations and geometry configuration. This fact has been already studied in [?], [?] and [?] for chains, in [?] for 2D structures and in [?] and [?] for the 3D case. However, most of the studies have been focused on the geometry needed to achieve the least magnetic energy and this question has been solved for 1D and 2D structures, but it seems to be yet an open question for the 3D case as mentioned in [?] and [?]. On the other hand, only a few studies have been adressed to the dynamics for simple configurations [?] and using a Lagrangian approach in [?] and [?].

I. EXPERIMENTAL SETUP

The experiments were performed using magnetic

II. RESULTS AND DISCUSSION

Tensile strength of a single chain: The first system to be analyzed is a linear chain

Conclusion:

In mechanics of continuous media it is stated that the elastic properties of...

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[1] Hall, Cameron L., Dominic Vella, and Alain Goriely. The mechanics of a chain or ring of spherical magnets, SIAM Journal on Applied Mathematics 73.6: 2029-205 (2013).