



Mathematical modeling of magnetostrictive nanowires for sensor application

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Magnetostrictive wires of diameter in the nanometer scale have been proposed for application as acoustic sensors [Downey et al., 2008], [Yang et al., 2006]. The sensing mechanism is expected to operate in the bending regime. In this work we derive a variational theory for the bending of magnetostrictive nanowires starting from a full 3-dimensional continuum theory of magnetostriction. We recover a theory which looks like a typical Euler-Bernoulli bending model but includes an extra term contributed by the magnetic part of the energy. The solution of this variational theory for an important, newly developed magnetostrictive alloy called Galfenol (cf. [Clark et al., 2000]) is compared with the result of experiments on actual nanowires (cf. [Downey, 2008]) which shows agreement.

Subjects: **Materials Science (cond-mat.mtrl-sci)**; Mathematical Physics (math-ph)

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