Magnetostatic waves in magnetic periodic structures

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We propose a modified Walker equation that can be used for describing propagation of magnetostatic spin waves in inhomogeneous magnetic medium. The equation is employed for studying the dynamics of magnonic crystals, *i.e.* structures composed of periodically distributed different magnetic components. The equation of motion is solved numerically by means of the plane wave method, adopted from photonic crystal band structure calculations. The presented computation results refer to superlattices composed of alternating layers of different ferromagnetic materials or of ferromagnetic materials separated by a non-magnetic interlayer. The results include the effect of material (spontaneous magnetization and anisotropy field values in the component materials) and structural (filling fraction) parameters on the magnetostatic spectrum of the considered structures. We interpret the resulting spectra within the magnonic model. The calculation results allow to present the investigated structures as magnetostatic wave-based devices – filters or mirrors – with spectrum position continuously controlled by modifying the applied magnetic field. We intend to use this approach for determining magnetostatic spectra in 2D and 3D magnonic crystals, and especially in dipolar systems composed of magnetic dots (antidots) periodically distributed in a nonmagnetic (magnetic) medium, and representing the magnetostatic counterpart of photonic crystals.

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