Spin-wave spectrum of 2D magnonic crystals with elliptically shaped scattering centres

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Magnonic crystals (MCs) are the subject of a very intensive research activity caused by their potential applications, including microwave resonators, magnonic waveguides, spin-wave emitters and filters. For example, the latest results of micromagnetic simulations indicate the occurrence of wide magnonic gaps, implying a possible application in spin-wave filters, in 2D Fe/YIG MCs. A particular role in the modeling of magnonic gaps is played by the deformation of the scattering centers in the plane of spin-wave propagation. In this study we examine the possibilities of tailoring the spin-wave spectrum of 2D MCs that could be used for fine tuning of spin-wave filter passbands. Our approach is based on Maxwell's equations for magnetostatics, solved by the plane wave method. We present the magnonic band structure of a Co/Fe MCs with scattering centres in the shape of elliptic cylinders. We find that for different filling fraction values there are specific in-plane rotation angles for which modifying the rod ellipticity can alter the position of the allowed band without changing its width, or cause a substantial shrinking of two adjacent bands without changing the width of the gap between them. Thus, an appropriate use of rods of elliptical cross section offers additional possibilities in the design of spin-wave filters with precisely adjusted passband.

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9.7 cm

13.4 cm

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