The formulation of the exchange field in the Landau-Lifshitz equation for spin-wave calculations in two-dimensional magnonic crystals

M. Krawczyk, J. W. Klos, S. Mamica, M. L. Sokolovskyy and M. Mruczkiewicz

Surface Physics Division, Faculty of Physics, Adam Mickiewicz University, Umultowska 85, 61-641 Poznan, Poland

9.7 cm

The calculation of magnonic spectra by the plane wave method (PWM) has limitations, the origin of which lies in the formulation of the effective magnetic field term in the equation of motion (the Landau-Lifshitz (LL) equations) for composite media. In the PWM the system dynamics is described in terms of plane waves (a superposition of a number of plane waves), which are continuous functions and propagate throughout the medium. Since in magnonic crystals the sought-for superposition of plane waves represents the dynamic magnetization, the magnetic boundary conditions on the interfaces between constituent materials should be inherent in the LL equations. We present the derivation of the exchange field term from the Heisenberg model in the linear approximation for magnetic composites. We discuss the magnetic boundary conditions included in the proposed formulation of the exchange field, and elucidate their effect on spin-wave modes and their spectra in two-dimensional magnonic crystals. A comparison with other formulations known from the literature allows us to clarify various kinds of exchange terms and specify magnetic systems to which they can be applied.

The research leading to these results has received funding from the European Community (FP7/2007-2013) under Grant Agreement no. 228673 (MAGNONICS).

13.4 cm

Subject category :

3. Magnetic Structure and Dynamics

Presentation mode :
poster

Corresponding author :
M. Krawczyk

Address for correspondence :
Faculty of Physics, Adam Mickiewicz University, Umultowska 85, 61-641 Poznan, Poland

Email address :
krawczyk@amu.edu.pl