Spin wave spectra in the Fibonacci sequence of magnetic wires in crossover of dipolar-exchange regime

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The main goal of our research was to investigate the spin wave spectra in fractal magnonic system. Thus we have investigated theoretically 1D Fibonacci sequence of Co and Py infinite long wires of the same dimensions, being in the direct contact, which ensures the exchange coupling between them. The system is saturated by the external magnetic field applied along wire axis. We have performed numerical calculations using finite element method. The results for Fibonacci sequences were compared with the magnonic spectra of respective periodic systems composed of Co and Py wires. We have found in the aperiodic system the reach magnonic spectrum with numerous magnonic band gaps being converged for sufficiently large rank of the Fibonacci sequence. Moreover, within the magnonic band gaps the isolated surface states were observed, which frequency is shown to be sensitive to the endings of the magnonic system. The conclusions are supported by the spatial distribution of a dynamical magnetization.