Excitation of short wavelength spin waves in ferromagnetic conduit with microwave pumped perpendicularly magnetized nanodot

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One of the main research directions in magnonics focuses on excitation of the short wavelength spin waves (SWs). Recently, a few approaches have been proposed, but each of them have some limitations, while lack of the efficient source of SWs limits further development of magnonic applications. We propose local excitation of SWs in a thin ferromagnetic waveguide with the help of nanodot, that possesses perpendicular magnetic anisotropy. Our idea is to use confined SW modes in nanodot pumped by a global microwave magnetic field directed along the magnetization of the waveguide, which will emit propagating SW due to direct static and dynamic coupling with the waveguide. Two study cases are put against each other: a nanodot inscribed with a skyrmion and a nanodot in a fully saturated state along out-of-plane direction. We found the propagating SWs can be excited in a broad frequency band from a few to dozen GHz, in both scenarios. Interestingly, the propagating SW modes are antisymmetric across the waveguide width and their wavelength can be shorter than 100 nm. Furthermore, our studies look for the magnetic parameters and geometry that would be most suitable for an efficient conversion of global electromagnetic radiation to short wavelength SWs. We believe, that the demonstrated in micromagnetic simulations local, limited to the size of the nanodot, excitation of SWs in soft ferromagnetic conduit strongly support further development of magnonics.

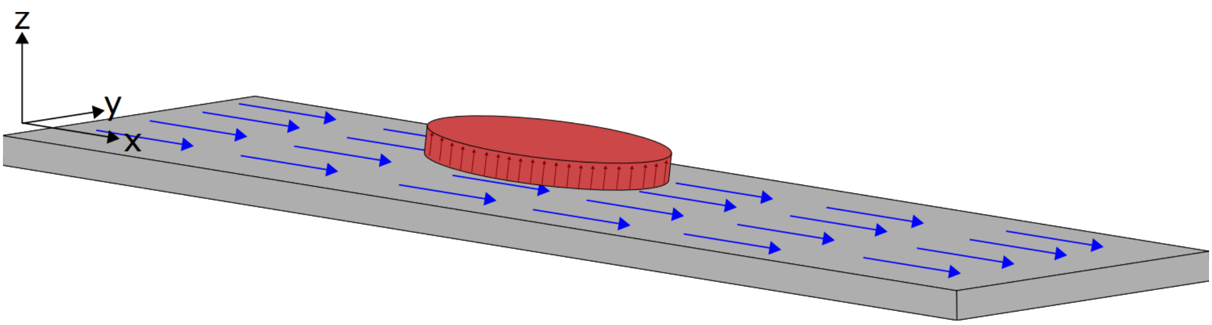

Figure 1: The waveguide and the disk, separated by a vacuum layer, the system used in micromagnetic simulations.

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