Japan Atomic Energy Agency / Tohoku Univ. Technology

Compact and low-cost inductor element

New inductor element using spintronics technology

Overview

An inductor is known as an element that uses the induced electromotive force generated in a coil to stabilize the current in circuits. Circuit elements used in small electronic devices require miniaturization, but there is a fundamental limit for conventional inductors due to a physical restriction. This invention uses the principle of induction in spintronics physics, as the inventors have shown, that inductance emerges in uniform magnetic materials as a result of spin-orbit interaction, where any “twists” are not required like conventional coils or magnetic structures. This technology offers various inductor elements that are low-cost, stable against temperature variation, and capable of miniaturizing.

Product Application

- Inductor

Features・Outstandings

	Conventional inductor Invented in 19th century	Emergent inductor Predicted in 19th century Demonstrated in 20th century	Spin-orbit emergent inductor Newly predicted in this research
Element size dependency	Strength is proportional to size (Unfavorable for miniaturization)	Strength is inversely proportional to size (Favorable for miniaturization)	Strength is inversely proportional to size (Favorable for miniaturization)
Resonance frequency	$(LC)^{-1/2}$	Helical pinned frequency (~0.1-1MHz)	Ferromagnetic resonance frequency (~1-10GHz)
Modulation by gate power	Not possible	Not possible	Possible

Fig.1 Comparison between the spin-orbit emergent inductor predicted by the inventor's research and already known inductors
(L and C indicate the inductance and the capacitance of coil, respectively)

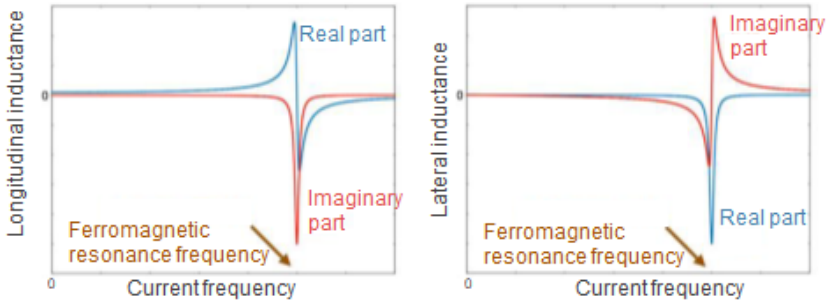

Fig. 2 Frequency characteristics of the spin-orbit emergent inductor in a magnetic material with the uniaxial magnetic anisotropy obtained in the inventor's research: inductances in the longitudinal (left) and lateral (right) directions relative to the current direction
(Both longitudinal and lateral inductances are normalized)

IP Data

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