Artificial magnetic lattices and their applications in optical and spin wave micro-devices

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Introduction of artificial magnetic structures into existing magnetic materials sometimes produces novel functions to waves accompanying magnetism. Nano-scaled or submicron-scaled artificial magnetic lattices (AMLs), involving magnetophotonic, volumetric magnetic holograms[4-5], even labyrinthian magnetic domain structures, for optical (electromagnetic) waves, and magnonic crystals for spin waves, can be classified into such materials. In this subject, fundamental properties of such AMLs mainly with magnetic garnet films and/or thin alloy films are discussed, followed by demonstrations of their applications in optical and spin wave micro-devices driven by magnetic phase interference: magneto-optic (MO) volumetric hologram memories and MO three-dimensional holographic displays[6-8] both with magnetophotonic crystals; high-speed MO Q-switch micro-chip laser with iron-garnet films with labyrinthian magnetic domain structures[9-10]; and highly sensitive magnetic sensors and spin-wave logic circuits[11-13] both with magnonic crystals. Prospective future technologies of spin wave devices with AMLs will also be discussed toward a new paradigm of magnonics (electron non-transport electronics), where spin waves play an important role as the information carrier.

Biography

Mitsuteru Inoue received Ph.D. from Toyohashi University of Technology (TUT) in 1989, and he is now Executive Trustee and Vice President of TUT. His expertise lies in the field of magnetic materials and their applications. In particular, he is interested in the interaction phenomena between spin system and various physical quantities including light (electromagnetic wave), acoustic wave, electron transport, heat transport. Recent his works are focused on materialization of novel functions with existing materials by introducing artificial structures. Along these works, he is now working on magnonics, in which spin waves are controlled by artificially introduced magnetic structures. He has published more than 250 full papers on the above fields. He was a visiting professor of Stanford University and Moscow State University. He received outstanding award from Magnetic Soc. Japan, and from Ministry of Education, Science & Technology, Japan.

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