

This thesis aims to (i) design and optimize the geometry of magneto-photonic crystal based on ferromagnetic garnet in order to resonantly enhance the magneto-optical response, (ii) to explore the possibility of using magnetic shape memory alloy to build an optically active photonic element, using advanced FDTD modeling. A Faraday rotation of  $180^\circ$  was reached but with low values of transmissivity. An investigation of the origin of such high values of Faraday rotation led to a conclusion that such structure has to be highly sensitive towards a change of a refractive index of its surroundings. This was confirmed, and so further development of this structure can lead to an efficient concentration detector. Three designs of optically active element utilizing deformation of magnetic shape memory material in the external magnetic field were numerically simulated. Two designs (photonic crystal with cylindric holes in a hexagonal lattice and self-standing foil with cylindric holes in a square lattice) proved to be efficient and worth of further development.