Evaluation of an ultrasonic liquid crystal lens

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New technologies for adaptive optics are becoming increasingly important for miniature devices such as cell-phone cameras. The human eye is an example of adaptive optical system, comprising of cornea, pupil and lens. The cornea is responsible for most of the optical power. The pupil acts as an aperture that controls the amount of light that forms images on the retina, and the eye lens can adjust its shape via the ciliary muscles, working as a variable focus lens. Conventional optical systems are based on mechanically moving parts of glass or plastic lenses to adjust focus, magnification, and field of view. Miniature adaptive lens, however, is an alternative to change focal lengths while eliminating the need to mechanical moving parts. Many adaptive lenses that mimic eyes have been developed to replace the multiple solid elements in optical systems. Among these approaches, liquid crystal material is an attractive alternative to replace this conventional optical system based on solid elements, because of its easy controllability by using an external field. The light traveling through the liquid crystal medium bends at different angle depending on the orientation of the liquid crystal molecules in response to a control signal. The combination of nematic liquid crystals and their technology to focus light, in combination with ultrasound actuation to improve the lens efficiency and flexibility presents a promising alternative for tunable lenses. For ultrasonic liquid crystal lenses, the geometry of the lens and the design of the piezoelectric transducer are critical factors.

Short biography:

Jessica Onaka received the B.S. degree in electrical engineering from the Federal University of Amapa, Amapa, Brazil, in 2018, and the M.S. degree and PhD degree in electrical and electronic engineering from Doshisha University, Kyoto, Japan, in 2020 and 2022, respectively. She was selected as the Receiver of the Japanese Government (MEXT) Scholarship from 2018 to 2022. She worked as an Optical Design Researcher at Huawei Research Center, Optical & Quantum Communications Laboratory – Jena Office, Thuringia, Germany from 2022 to 2023. Currently, she is an Assistant Professor in Utsunomiya University, Center for Optical Research & Education (CORE), Tochigi, Japan.