



Nakamura Lab

Optics & Ultrasonics for Sensors & Actuators

Applied Electronics Research Core, FIRST

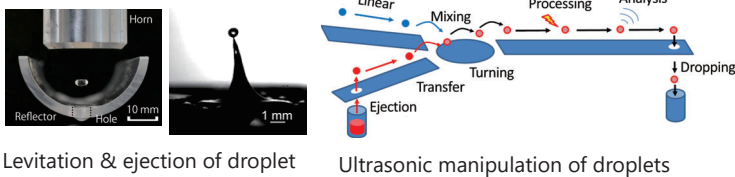
<http://www.nakamura.pi.titech.ac.jp/>

- Fiber-optic distributed strain & temperature sensing
- Ultrasonic non-contact manipulation of small objects
- Smart sensors for industrial and medical applications

Based on wave phenomenon such as light and ultrasound, we have been developing novel sensors and actuators that are difficult to achieve by other methods. Our research targets include unique sensors based on opto-ultrasonic interaction (wave parametrics), ultrasonic motors with compactness and high torque, and non-contact manipulators for small objects and droplets.

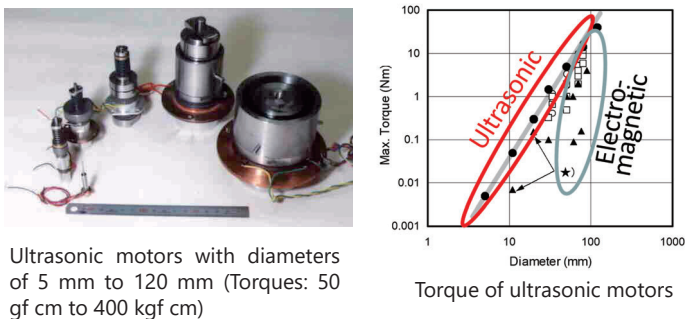
Non-contact manipulation of droplets

Non-contact trapping, transportation, and mixing of droplets can be performed by controlling airborne ultrasonic fields. Ejection of a single droplet from a microwell can also be conducted using focused ultrasound. These techniques are of great use for next-generation drug and material industry.



Compact high-torque ultrasonic motors

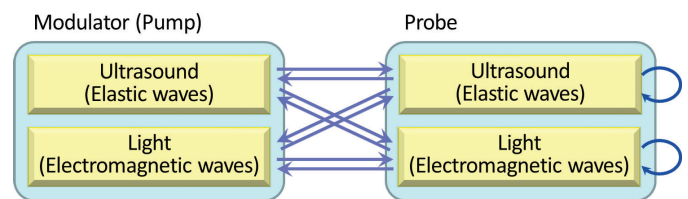
Ultrasonic motors, which operate based on the friction force caused by an ultrasonically vibrated rotor, are generally compact and high in torque. To enhance their performance, we have been trying to exploit functional lubricants and new materials.



Ultrasonic motors with diameters of 5 mm to 120 mm (Torques: 50 gf cm to 400 kgf cm)

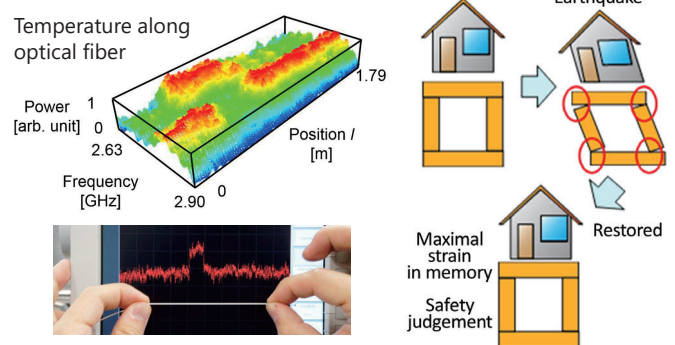
Concept of "wave parametrics"

Light (or electromagnetic waves) and ultrasound (or elastic waves) interact with each other. Namely, ultrasound can be generated by light, and light can also be modulated by ultrasound. Unique measurement and sensing can be performed by use of this concept "wave parametrics."



Real-time fiber-optic distributed sensors

Optical fiber sensors give us the information on strain and temperature distribution along the fibers. We have been enhancing their performance (especially, spatial resolution and operating speed) for wide range of applications from civil infrastructure to robots.



Ultrasonic multi-spectral cameras

We have been developing new imaging devices using wideband (ultra)sound. They provide us with such information as is totally different from that obtained with optical cameras.

