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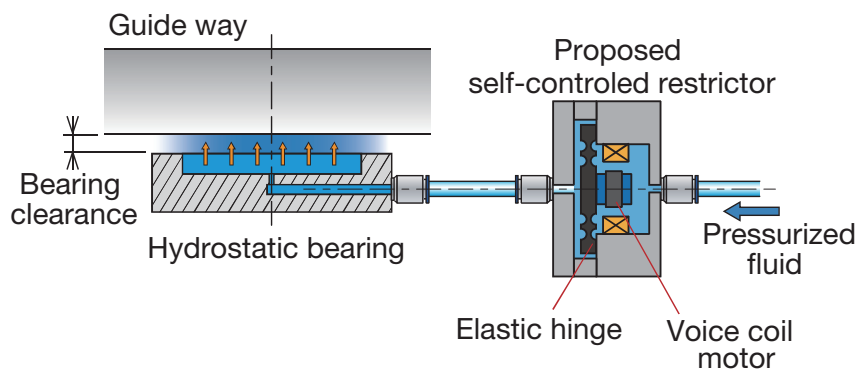
## Purpose of Research

To present solutions of problems related to tribology

## Summary of Research

Research area of our laboratory is related to one of machine elements, a fluid film lubrication bearing (FFLB) to support or guide an object using a lubricant such as oil, water and air. Therefore, the object can be supported by a lubricant without any direct contact between bearing and object surfaces. A newly developed FFLB can control the bearing clearance very precisely by controlling the flow rate entering the bearing clearance. A noncontact chuck we proposed can support a small object using ultrasonic levitation technique and hold a small object both horizontally and vertically without any contact. Moreover, a magnetic ionic liquid has been developed for a magnetic fluid seal used in a vacuum environment.

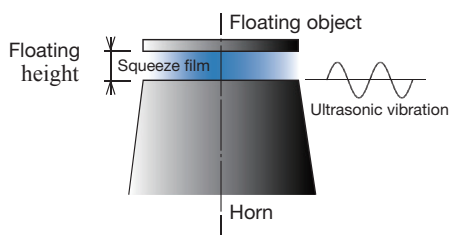
### Hydrostatic Bearing & Flow Rate Control Unit



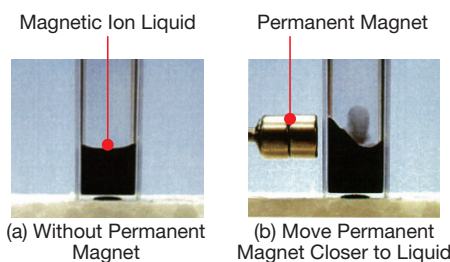
### Comparison with Conventional or Competitive Technology

A proposed FFLB has a small-sized flow control unit with high-speed response to control the bearing clearance with the nanometer order of accuracy. When this proposed bearing is applied to a guideway of machine tools, higher accuracy of movement of the guideway table can be achieved compared with conventional hydrostatic bearings during cutting process. A developed non-contact chuck can hold a floating object without any contact by using the ultrasonic squeeze effect. The proposed chuck does not need an external air source such as a compressor which a Bernoulli chuck does.

### Non-contact Chuck



### Magnetic Ionic Liquid



### Expected Applications

- Ultra-precision machine tools
- Ultra-precision measuring equipment
- Non-contact conveying device

### Points

- A fluid film lubrication bearing (FFLB) can support a shaft and a guideway table by a fluid film. FFLBs can achieve low friction and high accuracy of movement of a supporting object even when an imposed load on the object is varied
- We proposed a flow control unit that could precisely control the flow rate of lubricant entering a FFLB, and a very precise positioning control of the object became possible
- We developed a small noncontact handling device by using the ultrasonic squeeze effect

### Future Developments

Open "Tribology Center" at Katsushika Campus on April 2015

International Tribology Conference 2015 (held by Japanese Society of Tribologists, Site: TUS Katsushika Campus)

■ Intellectual Property:  
 Japanese Patent No. 04376737 "Non-contact Chuck"  
 Japanese Patent Application No. 2014-226961 "Compound, Method for Preparing the Same, Magnetic Fluid Composition, Method for Preparing the Same, and Magnetic Fluid Sealing"

