Fluid Science Research Group

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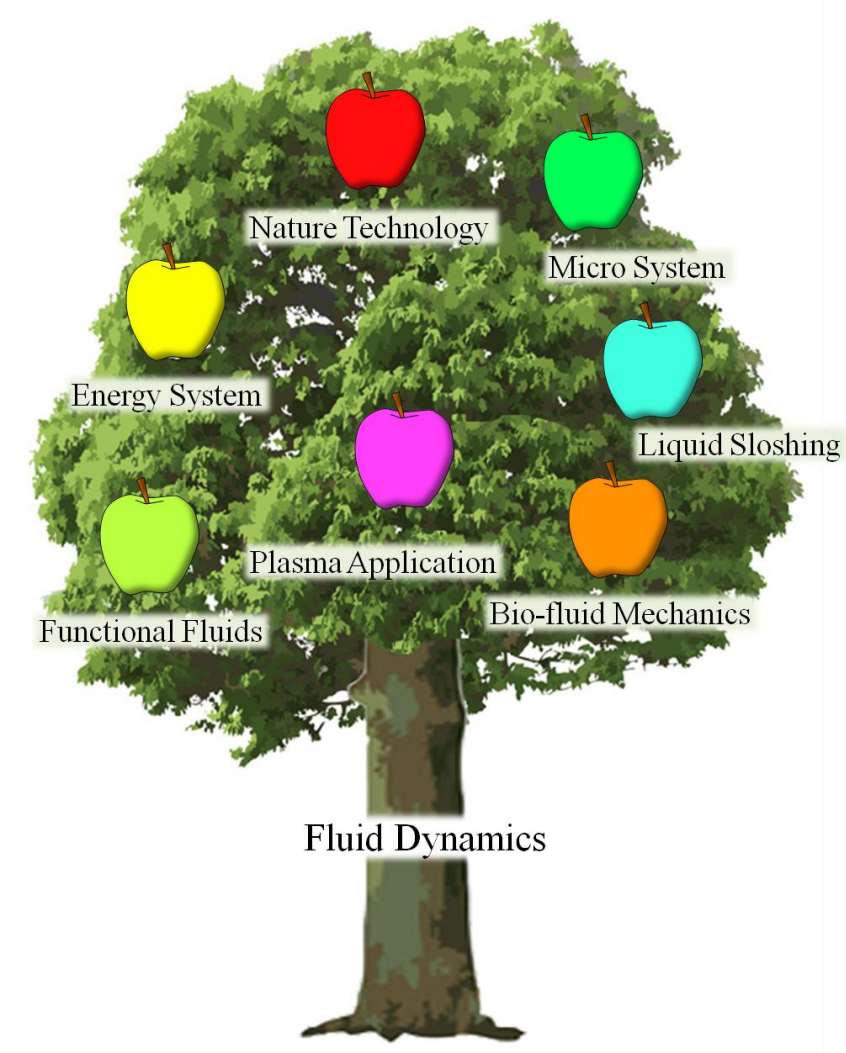
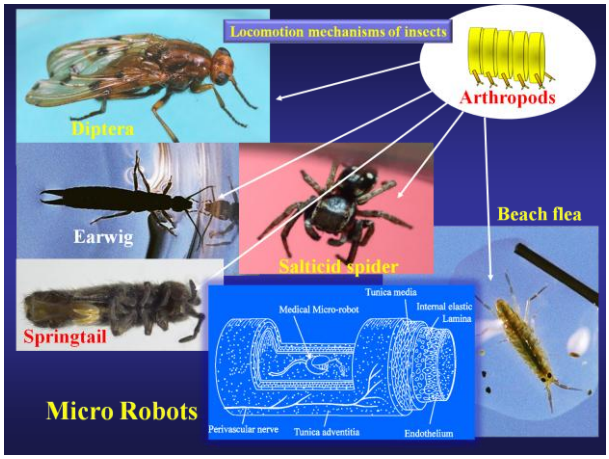
Fundamental and Applied Researches based on Fluid Dynamics

We have been conducting academic and applied researches on fluid science. Our researches are based on Fluid Dynamics. Our purpose of research activities is to contribute to the lasting growth of human society. Our research interest includes **nature technologies**, **intelligent fluid systems**, **fluid dynamics of plants**, **violent liquid sloshing phenomena**, **plasma applications**, **superconducting systems**, and **biomedical engineering**.



Nature Technologies [*1]

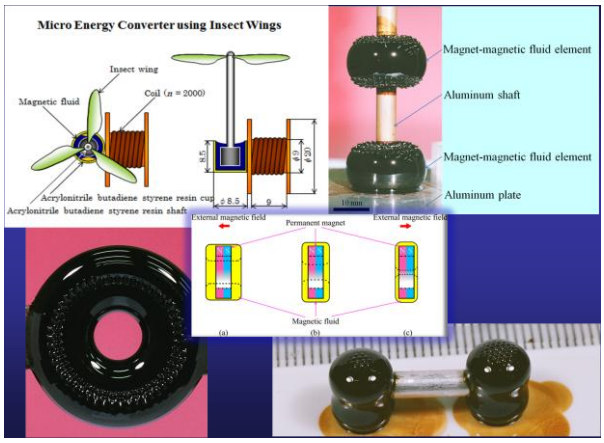
A wide variety of living creatures live on this planet. Insect's superior functions, designs and locomotive capabilities as a model for engineering have always inspired technology. We have been studying Biologically Inspired Technologies to solve engineering problems and to develop micro mechanisms, micro machines, and micro mechanical systems.



Intelligent Fluid Systems [*1]

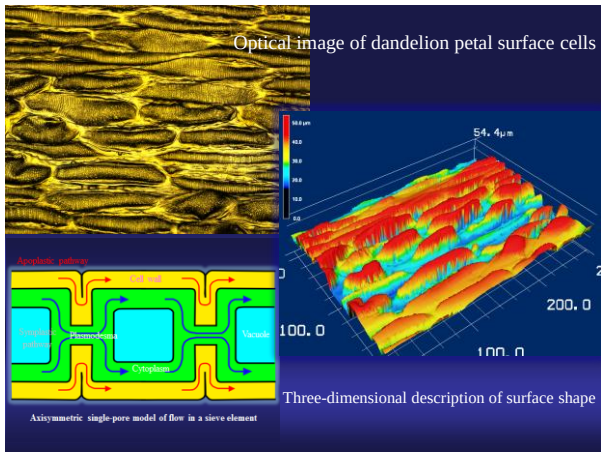
Magnetic fluids are ultrastable colloidal dispersion of small single-domain particles of ferri or ferro magnetic materials. The fluids respond readily to magnetic fields and have a saturation magnetization. In regard to many applications, it is very important to investigate the fundamental responses of magnetic fluid to applied magnetic fields.

We have been studying the interfacial stability of magnetic fluid subject to magnetic fields. We have been also proposing novel micro electromechanical devices using permanent magnet and magnetic fluids.

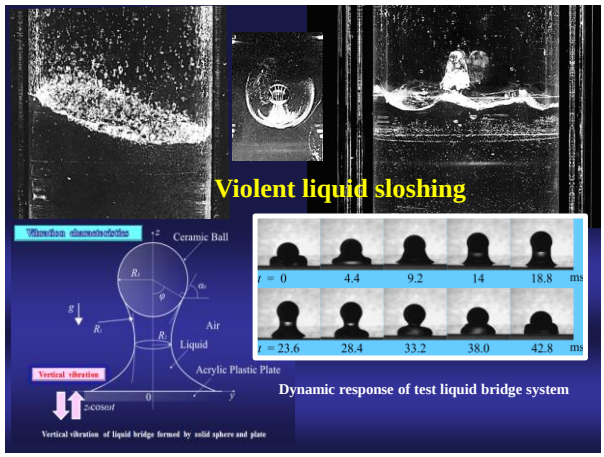


Fluid Dynamics of Plants [*1]

The fluid mechanics of plants has been being studied by our laboratory members to obtain inspiration for innovative technology from nature. For example, aerodynamic characteristics of dandelion seeds and the process of the clock unfolding were revealed. Our recent interest is to reveal the flow mechanism in the vascular tissue of plants. The process of photosynthesis requires sunlight, carbon dioxide, and water. Photosynthesis is the ultimate process of conversion of solar energy to stored chemical energy.

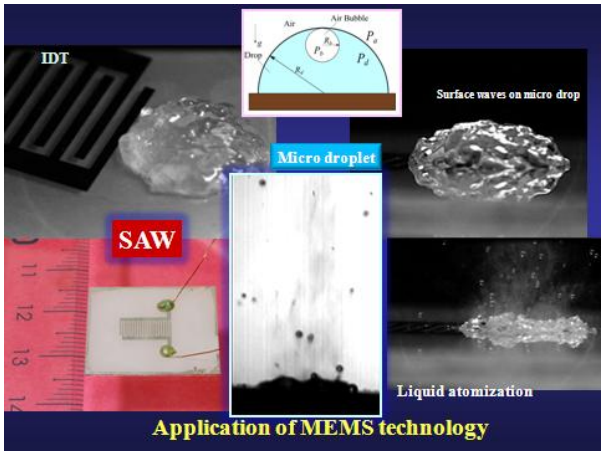


Violent Liquid Sloshing Phenomena [*1]



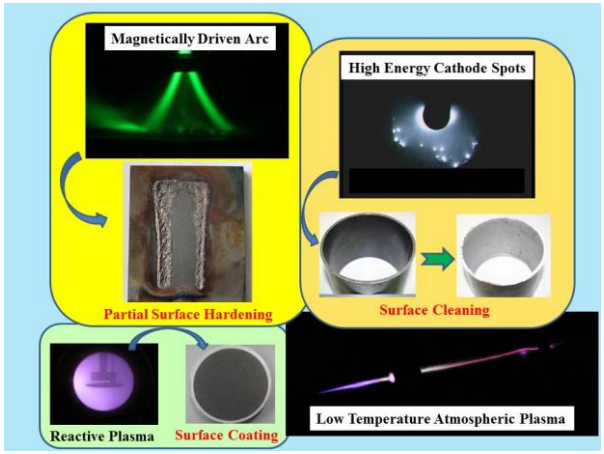
The dynamic behaviour of liquids in vibrating containers and the behaviour of gas bubble in oscillating pressure fields have been studied by our laboratory in relation to space technology. The free surface motion in vertically vibrated liquid becomes very violent at larger excitation acceleration of vibration, and the bubbles can become negatively buoyant. Excitation conditions for the formation of bubble cluster were obtained. Currently, our studies are on the way on the applications of violent liquid sloshing phenomena.

SAW-Liquid System [*1]



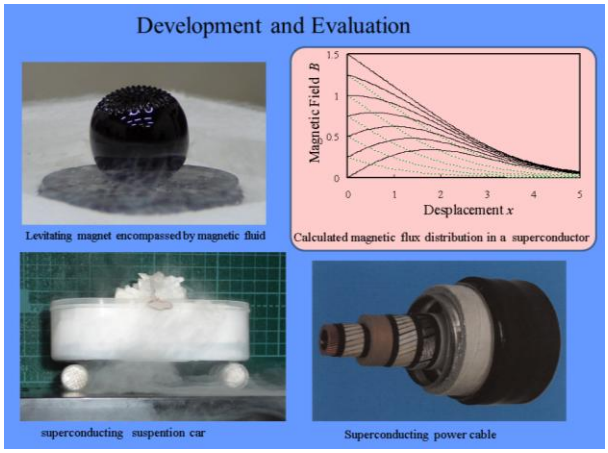
The importance of a study on the process of atomization is well recognized in fluid engineering. The process of liquid atomization using a surface acoustic wave device has been being studied in our laboratory. In particular, the effect of air bubbles in the micro droplet is investigated. The collapse of air bubbles has a significant influence on the gas-liquid interfacial phenomena.

Plasma Applications [*2]



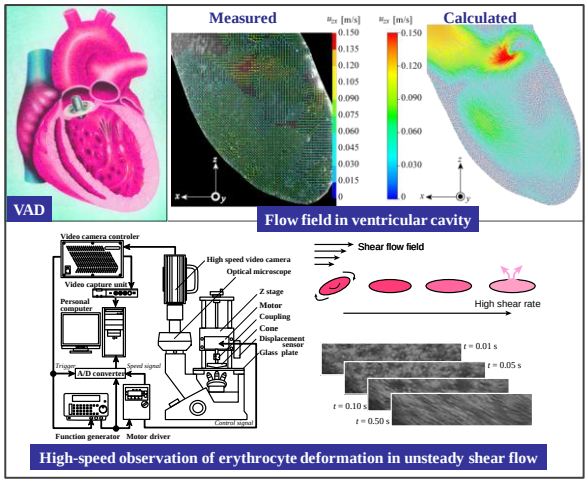
By use of plasma, high temperature ambient or high chemically active atmosphere can be attained easily because plasmas carry high density energy in themselves. In our laboratory, novel material process applications such as surface hardening, cleaning and coating using specific characteristics of arc plasma and reactive low pressure plasma have been researched. In addition, we are now ready to start studying low temperature atmospheric plasma applications.

Superconducting Highly Efficient Systems [*3]



Superconducting technologies contribute to low energy society and sustainable development. HTS(High Temperature Superconductor) cable, characterized by its ultra-high current density and super-low transmission loss, is a promising compact power cable with high transmission capacity. Superconducting magnetic levitation using bulk HTS is being applied to superconducting mechanical systems such as superconducting magnetic bearings. In order to optimally exploit the advantages of superconductors, we have been studying a method for evaluating the superconducting flux pinning effect, and to develop novel superconducting mechanical systems.

Biomedical Engineering [*4]



One of the crucial challenges for developing ventricular assist devices (VADs) is to decrease blood trauma including thrombosis and blood cell damage resulting from stagnation effect and high shear stress. We are aiming to develop novel methods to assess the blood compatibility of VAD.

- Numerical estimation of flow-induced hemolysis and thrombus formation
- Assessment of sublethal damage of erythrocytes
- Microscopic high-speed observation of blood cell deformation process in shear flow using microfluidic system