Electrical & Electronic Engineering

Plasma Physics Laboratory

We conduct research on a wide range of physics related to ionized gases.

The scope of the laboratory spans from plasmas at laboratory scales to those found within the solar system, including ion-generating devices based on surface sputtering and plasma flows produced by magnetic reconnection.
Recently, our activities have developed to include the study of dynamical interactions between plasmas and liquid surfaces, with a particular interest in potential applications in water treatment. Approximately fifteen students are currently preparing their master's theses in the laboratory. Two of them have academic backgrounds from higher education systems outside Japan. All student research activities are supervised by two university professors (T. Kasuya, H. N. Yoshikawa) and a researcher from industry, with additional contributions from international visiting scholars.

Fig. Deformation of a glycerine droplet induced by an electric field (left) and by a corona discharge (right).

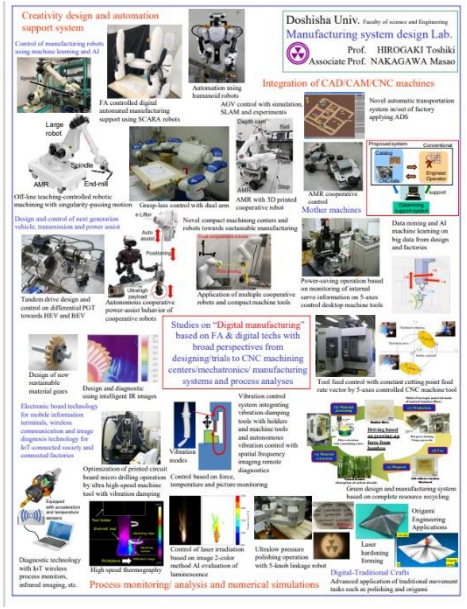
Mechanical Engineering

Manufacturing System Design Laboratory

Our laboratory conducts research on "digital manufacturing systems" based on mechatronics, automation, and digital technology, working from a broad perspective from design and prototyping to CNC machine tools, industrial robots, automated transport, sustainable production systems, and process elucidation.

With the development of computers, technological innovations such as machine learning and artificial intelligence (AI) are also actively introduced into our systems for the Internet of Things and information society. We are also engaged in research and development related to technologies for a sustainable society that considers the cooperation between humans and machines and the global environmental impact necessary for the next generation of manufacturing.
Although "the importance of manufacturing is universal," it is believed that "the technology of how to make things is constantly changing.

To meet the needs of a changing society, we will promote research and development of autonomous, distributed, and cooperative “production," "manipulation," and "transportation" based on globally applicable mechatronics technology.



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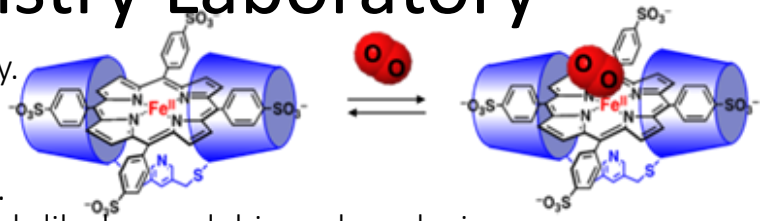
Chemistry

Functional Organic Chemistry Laboratory



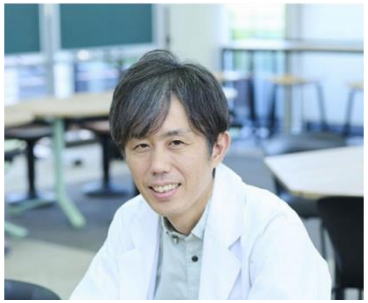
The research target of our laboratory is bio-mimetic chemistry.
In the biological field, functional biomaterials like proteins and DNA show essential functions for keeping their life.
For example, hemoglobin carries oxygen in blood of our body.
We are focusing on the structures and functions of biomaterials like hemoglobin and producing new molecules that show the similar functions to the biomaterials.

In the Kitagishi laboratory, a new biomimetic molecule was developed as the synthetic hemoglobin-like compound. The compound, named hemoCD, is the first and only one compound in the world showing reversible oxygen biding in water as well as in blood of mammals. Therefore, hemoCD, a biomimetic model of hemoglobin, can be used as the artificial oxygen carrier.

Recently, it was eventually found that hemoCD injected to the animal body could capture toxic carbon monoxide (CO) gas during circulation and excreted in urine. Prof. Kitagishi think that hemoCD can be clinically used as the CO antidote. There is no injectable antidote for CO poisoning worldwide though CO poisoning frequently occurs in the accidents such as building fire.

Prof. Kitagishi and his co-workers challenge the clinical use of hemoCD.
To realize this, fundamental research on the scale-up synthesis, toxicological, and pharmacokinetic/pharmacodynamic study of hemoCD are being conducted.

For more information: https://fire-gas-antidote.doshisha.ac.jp/en/



Life & Medical Sciences

Neuroethology and Bioengineering Laboratory

We conduct research on bat echolocation, focusing on how bats use ultrasonic sounds to perceive and navigate their environment. We perform a variety of behavioral experiments with captive bats and also conduct acoustic measurements and biologging studies on wild bats. Through these approaches, we aim to elucidate the remarkable navigational abilities of bats and apply the knowledge gained to engineering fields, including autonomous mobile robots.

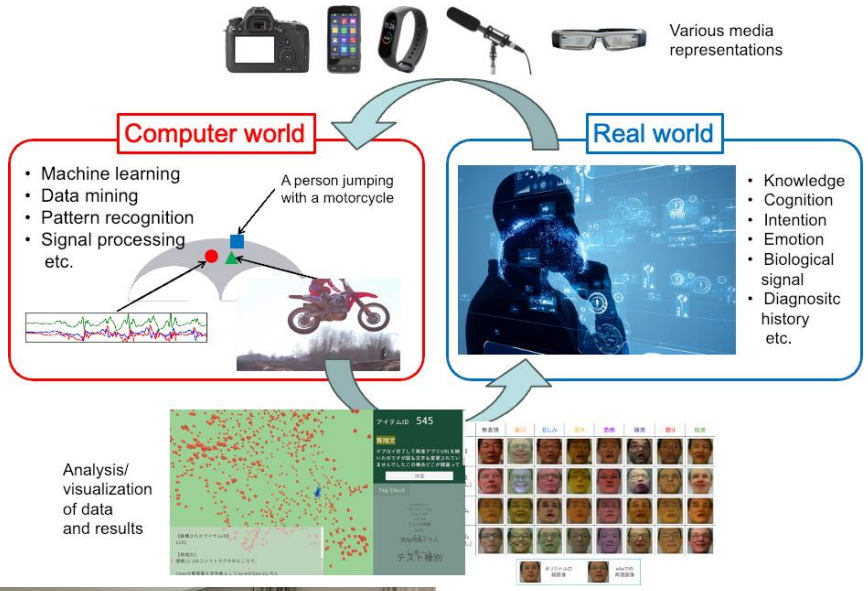
During the laboratory tour, visitors can observe multiple bats flying freely without colliding with one another. We hope this experience will allow you to appreciate the sophistication of their sensing abilities firsthand.

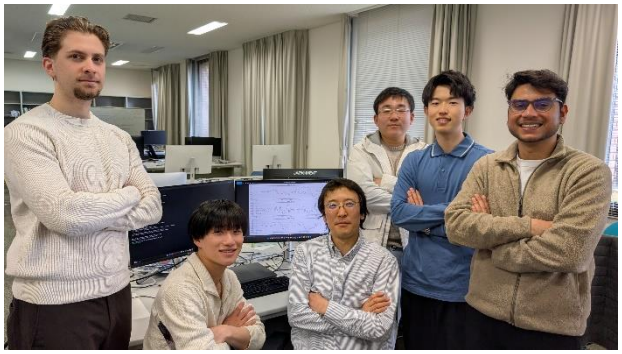
(Please refrain from participating if you have animal allergies.)

Information Science

Co-creation Informatics Laboratory

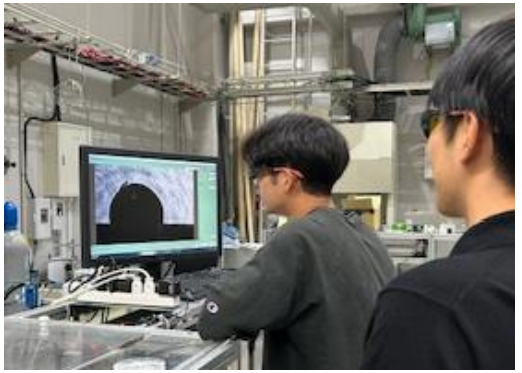
Our mission is to enhance human-computer collaboration and support human intellectual activities by effectively bridging between the real world and the computer world.
To this end, we focus on not only the methodological development in the fields of machine learning, knowledge discovery and multimedia understanding, but also the application of our developed methods to specific domains like healthcare and education.
One prominent characteristic of our research is the adoption of cloud-service platforms like AWS and high-performance servers equipped with many cores and GPUs for efficient execution of experiments.





Mathematical & Environmental Sciences

Earth and Space Materials Science Laboratory



Our research explores how materials transform, circulate, and generate functions under extreme conditions, from Earth to planetary environments.

We focus on non-equilibrium phenomena in molten materials, including phase separation, crystal growth, and metastable processes, using containerless techniques and advanced measurement methods.

Through these investigations, we seek to identify fundamental principles governing material behavior across Earth and planetary systems.