## **Division of Environmental Studies**

## **Department of Human and Engineered Environmental Studies**

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Multi-Scenario	Dr. Hiroshi OKUDA	Using advanced computational environments such as post-peta scale	High Performance	Title : Parallel Computing and Practical Finite Element
Simulation Laboratory	Dr. Gaku HASHIMOTO	supercomputer, CPU-GPU hybrid system etc., elucidation of various	Computing, Parallel Finite	Structural Analysis
(Okuda-Hashimoto		complicated phenomena inevitable to industrial design and	Element Method, Linear	(1-2 weeks) Parallel computing is learned from both sides
<u>Lab.)</u>		manufacturing and development of efficient simulation techniques	Equation Solver, Computer-	of hardware and software. Basis of Linux computer and
		and software have been done. Specifically, following three areas are	Aided Engineering,	network is learned and a PC-cluster ( a trial parallel
		focused on:	Structural Analysis	computer ) connecting several PCs is built. Parallel
		[Area 1] Research on HPC (High-Performance Computing)		computation using MPI ( Message Passing Interface ) is
		middleware for post-peta scale parallel computer system		experienced using the built PC-cluster.
		1-1 Common function libraries for parallel FEM (finite element		(1-2 weeks) Introduction of continuum mechanics,
		method)		structural analysis and FEM. These basic knowledge are
		1-2 Parallel iterative and/or direct solvers suitable on multicore,		necessary for doing the final stage of the project below.
		hierarchical and heterogeneous computer environments		(1-2 weeks) Do parallel finite element structural analysis,
		1-3 Cloud CAE system for parallel FEM structural analysis		which is widely used as a simulation tool in CAE field.
		[Area 2] Research on parallel structural FEM software "FrontISTR"		Besides the parallel FEM by "FrontISTR", CAD modeling,
		and its applications to industrial problems		mesh generation, setting analysis conditions and
		2-1 Numerical methods for nonlinear and/or coupled problems in		visualization of results are also learned.
		industrial design and manufacturing		
		2-2 Joint research projects with industries: Static analysis of		Participants are given work spaces and computational
		aneurysm imposed by pressure, Dynamic rolling contact analysis of		environments in our laboratory. Schedule is flexible
		wheel and rail, Large-deformation analysis of filled rubber, Seismic		depending on participants' background and the progress of
		wave propagation in large ground area with faults, Analysis of warp at		works. Contents of projects are not limited to the above
		reflow soldering of print circuit board, Thermal stress analysis of		depending on the participants.
		pressure vessel, etc.		
		[Area 3] Research on environmental agents for the simulation of		

		<ul> <li>building low-carbon society</li> <li>3-1 Common function middleware "MADS/SAGS" for multi agent simulation</li> <li>3-2 Diffusion simulation of low-carbon energy technologies e.g. fuel cell vehicle, building of hydrogen society</li> <li>3-3 Hybrid methods of CFD ( Computational Fluid Analysis ) and SOM ( Self Organization Map ) knowledge base for controlling temperature of molten steel</li> </ul>		
SASAKI Laboratory	Dr. Ken SASAKI	Our research activities are based on mechatronics and signal processing. Current research topics are human body communication (HBC) and environmental sound recognition (ESR). HBC utilizes human body as part of the electric signal transmission between wearable devices. Data transmission is established only when the devices are in contact with the user. We are interested in development of practical application devices and theoretical transmission model. The second topic ESR is a technique to recognize non-speech sounds such as sounds that we hear in our daily life and sounds of machines and facilities. Since composition of these sounds is different from that of the speech sounds, speech recognition methods do not work so well. Currently, we are focusing on continuous sounds that have random fluctuation in their spectrums, such as sound of running water, and on transient sounds that we hear in our daily life such as sounds of door knock and footsteps.	Electronic circuits, Data transmission, Sound recognition, Signal Processing	There are two projects relating to the two research topics described above. The first project is on human body communication. The aim of this project is to fabricate demonstration devices using human body communication. Activities will include electronics circuit fabrication and micro computer programming. The second project is on environmental sound recognition. The student will choose a particular sound that we hear in our daily life, sample the sound, and analyze the sound. The goal is to find parameters that can be used to differentiate the chosen sound from other environmental sounds.

Industry         Find, to biological systems. There are three research directions: (1)         Based modeling, Financial         Waiting student, basically relating to model construction           Systems Laboratory         Find, to biological systems. There are three research directions: (2)         Based modeling, Financial         waiting student, basically relating to model construction           Multi-agent cooperative evolutionary games for modeling and simulations of financial markets; (2) Discrete kinetic models for the simulation of complex fluids; (3) Cellular automata and heterogeneous stochastic agent models for the simulation of cancers.         Matters, Cancer         study depends on student's interest. It could be a financial market, a solution including colluid, or a growing tumorous tissue. Apart from the research activity, visits of the aupercomputer contract, activity, visits of the are also being scheduled.           Industrial Information         Dr. Kazuo HEKATA         In modern days, distributed human agents and affacts cooperate in highly networked information schubs, Out arget is to study about         Social wellans eavice, Log watership information schubs/going inclustes by ullizing advanced information technologies. Curr search hopic include deployment of wearable computers in shipbuilding and aicraft manufacturing, developing information management plaforms for product         Social wellans eavice, Log watership in downale particips size introduced this service for the purpose of supporting elderly's life by collaborating with accil wearable computers in shipbuilding and aicraft manufacturing.         Social wellans eavice, Log watanabies and like-cycle, designing new transportation systems based on simulations, brealing size distudion waterease do the nonlysis of t	Simulation of Complex	Dr. Yu CHEN	In our lab, fields of research range from social-economic, complex	Complex Systems, Agent-	In the program, a small project will be assigned to the
Multi-agent cooperative evolutionary games for modeling and simulations of financial markets: (2) Discrete kinetic models for the simulation of complex fluids; (3) Caliular automata and heterogeneous stochastic agent models for the simulation of cancersMarkets, Sol-condensed Matters, Cancerand computer simulations. The specific complex system for study depends on student's interest. It could be a financial market, a solution including coloid, or a growing tumorous tissue. Apart from the research activity, visits of the supercomputer center, scenic sites surrounding Tokyo, etc. are also being scheduled.Industrial Information Systems LaboratoryDr. Kazuo HIEKATAIn modern days, distributed human agents and antifacts cooperate in highly networked information society. Our target is to study about reforming and creating structures of industries by ullizing advanced information technologies. Our research topics include deployment developing information transportation systems based on the analysis of situation awareness of operators. The research topics include applied research, topic is the handle operation is these research, topic is to the industria developing information research topic is to the industry assembles using laser scameres. Development of information systems based on the analysis of situation awareness of operators. The research topics include applied research, topic is the development of accuracy measurement system for large size assembles using laser scames. Development of information system for an-demand transportation and the specific research topics is to detect musual behaviors of each elderly person topics is to detect musual behaviors of each elderly person topics is to detect musual behavior of each elderly person topics is to detect musual behaviors of each elderly person person, social welfare council an call e					
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			academic disciplines, such as engineering, information technology,		
are necessary to be integrated.			economics, business administration and domain specific knowledge,		
			are necessary to be integrated.		

Morita Laboratory	Dr. Takeshi MORITA	By pushing a piezoelectric material, electrical energy can be	Piezoelectric effect,	A practical experience is quite effective for starting
		generated; it means you can utilize this phenomenon for sensors or	Functional material, Energy	something new. In this project, a piezoelectric plate
		energy harvesters. On the contrary, by applying electrical field to the	harvesting device, Modeling	sandwiched with thin metal electrodes is provided to the
		piezoelectric material, mechanical strain can be obtained with		students. Flipping this plate, the electrical energy between
		piezoelectric effect, which contributes to be actuators. Without		two electrodes will be confirmed by monitoring the
		complicated structure such as an electromagnetic coil shape, a		oscilloscope. You can say that this is one of the energy
		conversion between electrical and mechanical energy is possible by		harvesting devices. Then, please modify the mechanical
		using the piezoelectric effect. Based on the high conversion efficiency		structure and the electrical circuit for the practical device
		and the large energy density, piezoelectric effect is utilized for		application. Of course we'll support you. You can use 3D
		medical acoustic devices, ultrasonic transducer, micro energy		printer and machining equipment.
		harvester and so on.		What do you want to utilize this piezoelectric plate for?
		Our group is interested in developing innovative piezoelectric		Wind force power generation? Or, do you want to get
		devices; for example, we proposes new driving principle of		energy from walking behaver by putting this material under
		piezoelectric actuator and sensor control system. At the same time,		yours shoes? Any idea is welcome, but maybe you don't
		we believe that breakthrough comes from the fundamental		like to study for boring topics. It's up to your proposal. After
		understanding of the piezoelectric effect itself. Therefore, the		making your device, a modeling for the device is conducted
		research field is not limited to the design of the transducer but is		to understand the piezoelectric effect.
		expanded to the nonlinear piezoelectric vibration, the dynamic		
		resonant frequency control and the shape-memory piezoelectric		
		actuator, which are related to the domain structure inside the		
		piezoelectric ceramics.		

Human and	Dr. Shin'ichi	At Human and Environment Informatics Laboratory, we are doing	Wearable sensor, Human	The project that our laboratory provides is to recognize
Environment	WARISAWA	research about both sensor devices based on new detection	behavior recognition,	human behaviors such as walking, running, laying, sitting,
Informatics Laboratory		principals, and daily life habit and environment monitoring system,	Machine learning, Java,	etc. by means of acceleration, angular velocity, and other
		aiming at contributing to the realization of a safe, secure, and	Matlab	sensor information. The recognition technique is one of
		comfortable society. Sensor device development researches are		key issues to realize wearable health monitoring systems
		currently conducting respiratory gas sensing devices which are		such as continuous wearable blood pressure monitoring
		realized by nano/micro mechanical resonator, graphene, and		systems that our laboratory has developed. The
		plasmonic devices based on nano/micro fabrication technologies.		necessary information can be collected by small units of
		Daily life habit and environment monitoring systems are researched		motion sensors or latest smart phone. Especially, the
		for wearable blood pressure monitoring, human behavior recognition,		project focuses on how to deal with individual differences.
		stress monitoring, and emotion recognition.		For this purpose, machine learning techniques are fully
				applied, and thus such knowledge and programing skills
				are very important.