List of Dissertation Abstract （Environment and System Sciences　System Design Course）

Name	Supervisor	Title	Abstract
Yosinori ASADA	Seiya UENO	Study on Deployment Method for Multi Unmanned Vehicles with Tracking Network	This study discusses on the deployment method for multi-agent system which is constructed by unmanned vehicles. The tracking network is one of multi-agent system. It is expected to connect network between two places divided by distances and obstacles. In this study, the deployment method for tracking network is proposed. This method is composite method which contains the network optimization method and the coverage control method. Moreover, in this study, new evaluation method is considered. In this study, a simulation result of tracking network system controlled by proposed method is showed.
Haruyuki IKEMASU	Motohiko MURAI	HydroHydrodynamic Response of Arrayed Point Absorber WECs Considering Hydrodynamic Interaction and Control Forces	A linear electrical generator is a kind of device which can be used to Point-absorber type wave energy converter, for directly converting mechanical energy of a floating structure into electrical energy. A wave farm consists of multiple Point absorber WECs which equipped in a sea area. In this paper, a numerical model is proposed considering `Hydrodynamic interaction' in the multiple floating structures, and the `Control force' of each linear electrical generator. We calculated the heave motion of plural floating bodies by the numerical simulation considering that 2 issues, and verified the method of evaluating the power generating performance of each body or the array-itself.
Takuo OGAWA	Kazumi MATSUI	A mixed formulation for multi-scale simulation method in finite deformations	In this paper, a mixed formulation for multi-scale simulation method is shown. In order to avoid volumetric locking caused by uncompressed problem, mixed formulation of 6 variables was done. This research made it possible to perform uncompressed multiscale analysis with lower computational cost.
Tomohiro KANO	Ken NAKANO	Liner wear of elastic block and rigid blade	In the sliding friction of elastomer, abrasion pattern (AP) orthogonal to the sliding direction may be generated in some cases. When AP is generated, machine performance and life span are reduced, so understanding of its mechanism is desired. Also, internal deformations of elastomer which can be important in understanding the sliding friction of the elastomer easily occurs. In this study, to understand the mechanism of AP generation, a novel experimental apparatus has been developed, which can obtain internal information. By using this device, the influence of the sliding speed on the AP was investigated and the results were classified.

Yuta KIMURA	Takehiro HIGUCHI	Study on Robust Guidance and Control Law using Variable Coasting Time for Lunar Lander	In this paper, a guidance and control law in the power descending phase for lunar lander is focused on. In this phase, guidance by the polynomial guidance law is operated. However, a calculation by this guidance law is sometimes diverged due to large error. In this paper, a variable coasting time is proposed to solve this problem. Comparing the velocity and the position at a start point and a target point, the coasting time is calculated by a simple equation automatically. In a simulation, an effect and an available range of proposed method are shown.
Takuhiro KUMAGAI	Takahiro YAMADA	Large Deformation Analysis of Tension Structures by using Level Set Boundary Expressions	In this paper, we propose a numerical procedure for large deformation problems of tension structures for surgical simulators. We employ Level Set method without element decomposition to analyze them. We discuss validity of this technique by comparing the conventional lagragian technique.
Moeko KOICHI	Takahiro YAMADA	On application of finite element analysis to evaluation of suture skills	Medical treatments are rarely evaluated as physical phenomena and the technique to evaluate skills of surgeons quantitatively needs to be developed. In this work, a numerical procedure using ALE finite element method is proposed to evaluate suture skills. In the present approach, sliding can be expressed in a form in which the soft tissue and the suture thread are always aligned in the deformed shape.
Shohei KOYAMA	Takehiro HIGUCHI	Study on Formation Control of Heterogeneous Vehicles Using Multi Poles	In recent years, demand for unmanned vehicle has increased and group control is an important technology. In this research, we aim to control to distribute vehicles with different objects in areas. In order to mix attributes, we introduce a pole control law simulating magnetic force. As a method for quantitatively evaluating the mixture of attributes, the mixing degree by information entropy is applied. By simulation, it was possible to confirm the mixture of attributes by visual and mixing degree.
Ryota SUZUKI	Takehiro HIGUCHI	Study on Trajectory Optimization of Multiple Aircraft Using Homotopy Method	This paper and simulations aim to establish the method of trajectory generation of Trajectory Based Operation (TBO). TBO requires trajectory calculation, but its method has not been established yet. In this paper, calculation method for trajectory optimization problem including conflict resolution is proposed.
Kensuke SUHARA	Kazumi MATSUI	Automatic generation of geometric model including membranes in human abdominal cavity	Some of the abdominal surgery have been performed by laparoscopic surgery in recent years. We have developed practical preoperative training simulators using patient particular data and surgery navigation system connecting the result of preoperative simulation with real operation electronically. The surgeon gets patient particular data by segmenting some required objects based on CT data manually. However, the system can’t currently generate membranes because it doesn’t recognize them from CT data. In this paper, we propose an automatic algorithm to generate geometric model for surgical operation simulator. It is included membranes in human abdominal cavity which can’t be recognized from CT data. We employ a level set method to morph the model that internal organs and membranes simultaneously.

Kenya SUMIDA	Kazumi MATSUI	Development Of Elasticity Modulus Identification System For The Soft Tisuue After Removal	Finite element analysis in the current surgical simulator processes organs and uses them as physical property values of the identified organs. The purpose of this study is to develop a system for identifying the elasticity modulus of the soft tissue immediately after removal using inverse analysis.
Tomoki DOURA	Toshihiko SHIRAISHI	A Study of Sound Source Separation Using Spectrogram Analysis by Neural Networks	According to the development of Deep Learning, the neural networks have been widely used in many kinds of fields. But the main use of the neural networks is classification problem, which classify inputs into appropriate categories by pattern recognition, and there have not been developed effective way to use neural networks to sound source separation problems. In this study, we developed a novel method to use neural networks to sound source separation by using spectrogram analysis, which could convert separation problems into classification problems. And by the simulations, we confirmed the validity and usefulness of the method.
Hidemasa NAKAJIMA	Takahiro YAMADA	Numerical evaluation of fluid with elastic deformations	This study considers that the deformation of the lubricated surface varies depending on the position. And this study evaluate the influence of the flow path deformation on the lubrication characteristics by using Fluid-Structure Interaction analysis. At that time, the patterns of the deformation of the wall was classified as translational deformation, angle change, elastic deformation, and the influence of each deformation pattern on the lubrication characteristics was evaluated using Stribeck curve. There are cases where the wall surface to be deformed is the upper surface and the lower surface. So, this paper proposed an analytical models for each cases, and evaluated the friction characteristics.
Yuki NAKAMURA	Toshihiko SHIRAISHI	A Study of a Mechanosensing System of a Cultured Osteoblast under Mechanical Vibration Considering Its Modes of Vibration.	Osteoblastic cells respond to mechanical vibration and generate the bone mass with a peak at a specific frequency like a resonance curve. However, a cell sensing mechanism to the vibration has not been clarified. To reveal the mechanism, the objective of this study is to observe a cell under the vibration focusing on cell deformation considering an analogy between cell biochemical response to the vibration and a resonance curve. We vibrated a cell on a microscope stage by an exciter and captured images with a high sensitivity and high speed camera.

Akitoshi NISHIJIMA	Toshihiko SHIRAISHI	A Study of a Proliferation Promotion Mechanism of Cultured Osteoblasts by Mechanical Vibration Focusing on β-catenin	This paper describes the mechanism of cell proliferation promotion by mechanical vibration focusing on β-catenin. In recent medical treatments, Low Intensity Pulsed Ultrasound (LIPUS) has been reported to promote fracture repair. However, it is unknown how cells sense mechanical vibration and transmit growth information. I focused on β-catenin which is a kind of protein related to cell proliferation. The frequency and the acceleration amplitude were set to 12.5 Hz and 0.5 G, respectively. The experiments indicate that the cell density of the vibration group was significantly higher than that of the non-vibration group after day 10.
Chiharu NIWA	Seiya UENO	Development of Experiment Multi-rotor UAV for Planetary Landing Flying Test Bed (FTB)	Researches and developments of a Flying Test Bed (FTB) for planetary landing have been advanced to develop landing technologies for planetary investigation such as the Moon and Mars in the future. In this study, a pre-experimental unit using Unmanned Aerial Vehicle (UAV) is prepared as an independent verification environment for FTB control system. In order to verify whether it is possible to fly as aircraft performance, a control law was examined by simulation introducing PD control and a flight test was conducted.
Shota HAYAKAWA	Shin MORISHITA	A Possibility of Learning and Memorizing of Cells through Signaling Network	Learning ability of cells has been examined by mathematical models of signaling networks. In cells, signaling networks are expected to play the part of a control system considering analogy with actual neural network. Mathematical models of signaling network are proposed and applied to map signals. The results show the possibility of learning ability of cells.
Takumi HOSHI	Takehiro HIGUCHI	Study on Guidance Control and Singularity Problem of Multirotor with CMGs	This study proposes a new multirotor equipped with Control Moment Gyro (CMG). The airframe has more potential than standard multirotor. However, there is a serious problem for CMG system. This is ‘Singularity problem’. In this airframe, any rotor error may cause singularity. Therefore, a control law is required for rotor error to avoid singularity. This study shows the fault diagnosis method using CMG input and the control input for any rotor error.
Hiroki MINAMIZAWA	Kazumi MATSUI	Method of Nearby Problems for Finite Element Analysis Considering Dissimilar Material Interface	Numerical simulation is utilized widely for shortening the development period and the cost cut including manufacturing industry in recent years. Therefore improvement of reliability becomes important. The approach called V&V which performs Verification and Validation is used as a confirmation method of the reliability. In this reserch, method of nearby problems is applied for the elastic finite-element analysis considering the dissimilar material interface. A lamp function is introduced to a basis function in order to make a characteristic of the discontinuity of strain on a dissimilar material interface. Numerical examples are shown to evaluate a characteristic and validity of this approach.

Ryohei MOCHIZUKI	Motohiko MURAI	A study on the motion of the twin floating vertical wind turbines equipped with Oscillating Water Column	Recently, the introduction of wind energy is progressing mainly in the developed countries as a key energy, and wind turbine steps forward on the sea. In 2013, Hashimoto studied experimentally a twin floating vertical wind turbines system. The system showed effective, but it was pitching in waves of comparatively short period. Therefore, I focus on Oscillating Water Column which is one of the wave generation types and is expected reduction in the motion of floating. In this study, I confirmed reduction in the motion by effect of OWC and power generation at the same time by calculating the motion of FOWT equipped with OWC.
Shota YAMAMOTO	Shin MORISHITA	A cell membrane protein's sensing function for vibration	The experiments focusing on a cell membrane protein under vibration and natural vibration analysis were conducted to reveal a mechanism of sensing vibration and translating into signals. Integrin, one of cell membrane protein and acts as cell adhesion, is one of most candidate for sensors of their dynamic surroundings. In order to access integrin was related to sensing vibration and cell response, we cultured 6 types of cells which express different conditions under vibration and constructed lumped mass-spring system of integrin and analyzed in NASTRAN. The results of experiments showed integrin attaching fibronectin is one of essential factors for sensing vibration and proliferation. The results of natural vibration analysis indicated the lowest natural frequency of integrin with fibronectin was in order of MHz.
Sungbae OH	Takahiro YAMADA	Method of Global-local Simulation For Marker Integration Finite Element Method	In this paper, I implement an effective remeshing method for local region assuming polycrystal model and restart function corresponding to multiple passes in marker integral finite element method. Through this, I constructed a series of flows which based on global - local non-coupled approximate solution method.