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

Name	Supervisor	Title	Abstract
Koki WATANABE	Ken NAKANO	Durability of concentrated polymer brushes in the vane edge loading sliding part of rotary compressor	Rotary compressor losses are known friction and leakage losses between a vane and cylinder. As an improvement of those losses, we focused on concentrated polymer brushes (CPB) which are macromolecule. In this study, the purpose was to show the possibility of applying CPB to rotary compressors. CPB coating vane was slid for a long time by the experimental apparatus simulating the compression mechanism. After that, the elastic modulus of vane surface was measured with the nanoindenter which is micro indentation tester. In this way, CPB was considered to remain in the valley of the roughness. Therefore, it is concluded that CPB has applicability to rotary compressors.
ken ASAMI	Motohiko MURAI	A Basic Study on Harminic Polynomial Cell (HPC) Method for Estimating 2D Fluid Field	In this study discussed accuracy of Harmonic Polynomial Cell (HPC) method which is one of methods estimating fluid field numerically. Because example of this method is few, it is not known its accuracy and usefulness. In this study, I examined free surface shape of an oscillated rectangular water tank by using a newly developed numerical code based on HPC algorism. By comparing the result with the experimental results, the rational “dt” for the simulation is discussed.
Keiuske AJIRO	Takehiro HIGUCHI	Study on Control of Using Polarity of Heterogeneous Vehicles	Recently, reliable autonomous technology for UVs are developing. In many cases, teams of UVs can accomplish tasks more efficient than single vehicle. Especially, this paper focuses heterogeneous group. Heterogeneous groups can be more distributed system than homogeneous groups. Control of heterogeneous group becomes complicated. So, we research about the gains and search optimal gains of polarity using genetic algorithm. The results show that it is possible to search the optimum gain of the control law using the polarity by using the genetic algorithm and the correlation of the optimal gain is not monotonically increasing or decreasing.
Daiki ARAI	Toshihiko SHIRAISHI	A Study of a State Recognition Method for Biological and Mechanical Systems by Vibration Measurement	A biological and mechanical system is the system which creatures interact with machines. Fishing systems are one of biological and mechanical systems. In this paper, I focused on a fishing system composed of fishing tools, an angler, and fish, investigated a state recognition method for fish using vibration data measured by sensors attached to fishing tools, and conducted the state recognition for three states of fish. As a result, I indicate that the proposed method can partially conduct the state recognition of fish using vibration data in fishing.

Yuko ISHIDA	Motohiko MURAI Shunji KATO	A Study on Availability Evaluation of Disconnectable Moored Spar Systems	The offshore oil and gas industry has been growing rapidly against a background of environmental issues, galloping oil price and exhaustion of fossil fuels. Therefore, it is important to develop ocean technologies to meet increasing demand for offshore oil and gas. Disconnectable moored spar systems, which consists of a moored spar buoy and articulated yoke system, are considered feasible in harsh nautical conditions. In this study, we proposed new supply chain system of offshore oil/gas with disconnectable moored spar systems and evaluated its availability.
Kazuya INOUE	Ken NAKANO	Measurement of rotation of friction vector generated in sliding friction	A device that can measure friction vector generated in sliding friction was developed. As a result obtained by this device, it became clear that the rotation of the kinetic friction occurred with occurrence of the stick-slip.
Tomoaki IHATA	Kazumi MATSUI	Identification of Hyperelastic Constitutive Law Considering Structure Deformation	In general, mechanical property of material in numerical simulations are determined from results of several material testings such as tension, compression, and shear testing. However, the stress state of material testing is different from that of the structure which is simulated in numerical simulations. Mechanical property should be identified by the material testing which have the similar stress state to the structure. This paper proposes the method to select the appropriate loading conditions in material testing by evaluating the stress state of the structure using stress analysis and tests the method.
Kurisu Ueno	Motohiko Murai	Experimental Study on Scale Effect of Oscillating Water Column	In recent years, the importance of marine renewable energy is increasing. One of the wave power generation systems has a mechanism for generating electricity by vertically moving a water surface in a cylinder called oscillating water column type wave power generator (OWC). It is said that the interaction of air volume, nozzle opening ratio and water surface change is important in OWC. However, we can not confirm the influence of draft, amplitude, period, etc. on OWC. Therefore, in this research, we conducted experiments using scales of different models to focus on the effect of scale.
Ryuki OTANI	Seiya UENO	Study on Navigation System for Planetary Lander	This thesis discusses the navigation system for planetary lander. In this thesis, the attitude angle and altitude detecting system, by using laser displacement sensor, is proposed. The effectiveness of proposed method is demonstrated by numerical simulation results and experiment using multi-rotor aircraft.

Akihiro ONO	Takehiro HIGUCHI	Study on Introduction of Uncertainty in Trajectory Optimization of Aircraft	In recent years, the demand of aircraft has increased. Therefore, we need to introduce new air traffic management system that can respond to increase in demand. In this research, we aimed to calculate the optimal trajectory that is considered of errors occurring during flight of aircraft. Especially when calculating the optimal trajectory, we examined how to get the same result as thinking about more points by thinking about some points. As a result, we could show how to determine the position of the representative point evaluating errors. Furthermore, avoidance by changing the departure time of the aircraft was also examined.
Hiroaki KATA	Seiya UENO	Study on control of tracking network with multi unmanned vehicles using virtual forces	In this study, Communication network formation and position control law for multiple unmanned ground vehicles(UGVs) to monitor a moving target at base station is proposed. A monitoring image of the target that acquired by a nearby UGV is sent to base through the tracking network. Each UGV forms a communication network and calculates own moving amount with virtual forces using only information in local area. In calculation of moving amount, two method were compared and examined. One is movement in virtual force direction and the other is movement using optimization method. Numerical simulations and experiments show the effectiveness of this control law.
kai KAWAGUCHI	Ken NAKANO	Influence of dynamic characteristics of contact part on formation of abration pattern	The abrasion pattern (AP) generated on the rubber surface is expected to be the product of flexible rubber and hard counterpart and dynamics at the contact part. Based on the hypothesis, we conducted a survey focusing on the relaxation time determined from the dynamic characteristics using a testing machine capable of measuring the dynamic characteristics (contact stiffness and contact damping) of the contact part. As a result, we found the relationship between the pitches of APs of different sizes and the relaxation time of the contact part, and created a flow of AP formation.
Manami KITAHARA	Seiya UENO	Study on Robust Polynomial Guidance Law for Lunar Lander	This paper is on polynomial guidance law for future lunar lander in powered descending phase. To achieve pin-point landing, the guidance trajectory needs to be accurate. Polynomial guidance law is low calculation cost to recalculate trajectory but improvement is required for robustness of error. This paper proposed optimal initial position method and approximate boundary condition method to thrust error in powered descent phase. These methods improve robustness of polynomial guidance law on not only in the thrust error but also in case of error in position, velocity and mass at the initial of powered descent phase.

Iyori KUSANO	Ken NAKANO	Finite Element Simulation of Point Contact Problem	For Concentrated polymer brushes (CPB) with excellent mechanical properties, it is known that durability is improved by attaching grooves to the substrate. In this study, I estimated this factor by using finite element simulation of point contact problem between rigid ball and elastic plate. It is known that the smaller the pitch of the groove the better the durability of CPB, but there was no clear difference in the model used in this study. From this result, I think that the major factor is some conditions those were not considered in this research.
Naoki KUWAHARA	Takehiro HIGUCHI	Study on analysis and evaluation method of approaching conditions for space debris capture	Recently, the number of space debris increase rapidly. So, we must take action to Active Debris Removal. One of the way of ADR is debris capture. In this study, the approach technique for debris capture close to the target space debris is investigated. Finally, this study focus on optimal approaching time and optimal initial relative position. It shows that the relative velocity of the satellite relative to the debris, approaching angle before the capture and required initial relative velocity are functions of the time from debris detection to capture. (90)
Natsumi KOYAMA	Ken NAKANO	Objective measurement on the feeling of using cleansing oil by machine learning	The good tactile sensation at the time of makeup removal using cleansing oil is one of the added value of cleansing oil and development of a cleansing oil with a feeling of use more preferred for humans is required. Therefore, in order to objectively evaluate the feeling of use of cleansing oil, a friction test was conducted on four kinds of samples mixed with cleansing oil and makeup, and the feature amount extracted from the time series signal was analyzed by clustering. As a result, it was found that the temporal change of the frictional force immediately after the start of sliding determines the difference between the samples.
Yuta SAITO	Takehiro HIGUCHI	Study on Motion Estimation of a Stalled Aircraft Based on Image Processing	This study discusses a method of motion estimation of a stalled aircraft based on image processing. For estimating states in nonlinear systems such as attitude motion of an aircraft, the Unscented Kalman Filter (UKF) is used be-cause of high-accurate performance. By UKF and statistical distance (Maharanobis Distance), characteristic points detected from image processing are identified and motion estimation are performed. Estimation by numerical simulation and experiment using a model aircraft was performed. Estimation results seem acceptable. And the flight characteristics at stall were observed by this method.

Sho SUZUKI	Kazumi MATSUI	Multi-scale simulations for failure process of carbon steel	In this study, the two-scale analysis method for ductile failure process is performed to explain the mechanism of damage evolution inside carbon steel. It is well known that a ductile failure comes from phenomena such as nucleation, growth and coalescense of voids. In order to reproduce the growth behavior of voids, it is necessary to consider the behavior of the interface between ferrite and cementite, which is the main inclusion of carbon steel. We propose what kind of modeling is appropriate based on observation image of voids, and carried out a simulation using that model.
Yuichi SUZUKI	Seiya UENO	A Study on Maximum Horizontal Movement in the Vertical Descent Phase of the Moon Lander	Currently in Japan "SLIM" plan is promoted as the next exploration plan. In this study, we attempted to increase the error absorption amount and the fuel margin in the vertical descending phase, and simulated the landing of the lunar probe using SLIM as a model. From this result, the ideal condition of orbit design was examined. As a result, the relationship between the trajectory design parameters, reachable distance and consumed fuel in the vertical descent phase was clarified. Moreover, from the obtained relation and the amount of propellant loading, it was possible to easily determine the trajectory design element that can safely land.
Kota NAGAI	Toshihiko SHIRAISHI	A Study of a Mechanosensing System of a Cultured Osteoblast under Local Dynamic Stimulation	Cells have mechanosensors that convert mechanical force into biochemical signaling. It is reported that one of mechanosensors is focal adhesions. Their mechanisms are not be clarified, especially when dynamic mechanical stimulation is applied. To make it clear, a magnetic micropillar substrate can be useful, which enable the mechanical stimulation to be directly applied to each focal adhesion. In this study, I measured the calcium response when local dynamic stimulation was applied and investigate a mechanosensing system of an osteoblast under the stimulation.
Fuminao NAGASAKI	Takehiro HIGUCHI	Study on the Automatic Recovery Control from Stall Using Model Airplane	Airplane accidents caused by stall are serious problem in these days. Training programs to recover from stall using small airplanes are provided by some companies. However, automatic recovery control system is in the process of research and development. This study tests recovery from stall by RC model airplane in the condition of simple nose up stall. Recovery is done by manual control or automatic control. In conclusion, automatic recovery is achieved and that reduce the loos of altitude.

Tomoaki NOZAWA	Toshihiko SHIRAISHI	A Study of Mechanical Vibration on Formation of Regenerative Tissue Using Cultured Chondrocytes	It has been reported that cells show adaptive response by sensing mechanical vibration. The mechanism of it is not clear but this phenomenon can be applied to regenerative medicine for articular cartilage. In this study, chondrocytes from porcine articular cartilage were cultured under mechanical vibration without scaffolds. Vibration condition was set as a sinusoidal wave of 12.5, 25 or 50 Hz, 0.5 G. As a result, effects of mechanical vibration on cell proliferation were not shown. On the other hand, the average thickness of chondrocyte cell sheets was increased by mechanical vibration at 12.5 Hz and 0.5 G.
Shohei HAMADA	Shin MORISHITA	Dynamic Characteristics of a Micro Mass-spring System	In this study, a very small mass-spring system was constructed and its dynamic characteristic was studied. The free vibration experiment was conducted to clarify its damping properties. As a result, it was revealed that the damping effect of internal friction increase with the volume of coil spring and that of air resistance is too large to ignore in micro scale.
Takuya HIURA	Shin MORISHITA	The Performance of Vibration Monitoring System using Swarm Intelligence	The performance of the vibration monitoring system using swarm intelligence were investigated. Swarm intelligence is the higher function or intelligence appeared in the network of agents. In this study, units composed of a sensor and a actuator were placed on the target system. Each unit was connected to each other to exchange information of displacement.
Taichi YAMAMOTO	Shin MORISHITA	The effect of medium sloshing caused by mechanical vibration on cell proliferation	It is known that osteoblasts cultured under mechanical vibration increase their density. However, the mechanism is not well known yet. To understand a part of the mechanism, the effect of medium sloshing caused by mechanical vibration on osteoblasts proliferation was investigated experimentally. It is suggested that the magnitude of shear flow caused by mechanical vibration is large enough to affect osteoblasts proliferation. It is also shown that without sloshing, the effect of mechanical vibration on osteoblasts proliferation is independent of the frequency in the range of 12.5 - 50 Hz.