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

Name	Supervisor	Title	Abstract
Fuka AMANO	Takehiro HIGUCHI	Study on Area Evaluation Method for Mitigation of Aircraft Noise Disturbance in Descending Trajectories	This paper discusses on the establishment of area evaluation method for descent trajectory to mitigate aircraft noise. The features of this new method are area evaluation and analytic solution. This method is established by a polar coordinates. The size of circle area that is over the standard noise value vary with flight altitude. By establishment of this new method, three results are achieved. First, aircraft noise value in the whole area is mitigated. Second, it is possible to set the specific area that needs to mitigate particularly in the evaluation area. Third, optimal trajectory is varied depending on flight altitude. This paper shows the availability of the method to simulate for actual operations.
Kohei ARAI	Seiya UENO	Study on Guidance Control of Parallel Ducted Fan Type VTOL Aircraft with Universal Joint Coupling	This study treats the effect of a universal joint placed between an airframe and a propulsion unit.　In order to analyze the control performance by the joint, some control systems are developed. Especially, the attitude controllers are basic and influential for position control and velocity control. The attitude controllers utilize the pole assignments for the stabilization, however, in the case of specializing in the propulsion unit, the zeros affect the stability.　According to the result of the simulations, the universal joint could enable the following effects: reduction of the inverse responses, improvement of the convergence, and reduction of the required force.
Taichiro ISHII	Shin MORISHITA	Structural Characteristics and Performance Evaluation of Self-organizing Neural Network	Neural network referencing the human brain has abilities of learning and nonlinear mapping. It has been applied in many fields such as recognition, identification and control for these abilities. Generally, back propagation method is used for learning in feedforward neural network. However, some learning tasks have not been well trained by this method. In this study, the leaning algorithm with changing its network structure is proposed. The rule of self-organization is based on the characteristics of complex network which has attracted attention in recent years. The ability of proposed algorithm was evaluated by learning two-spiral problem.

Shingo INAMI	Takahiro YAMADA	Multi-scale Simulation for Microscopis Voids Initiation/Growth Process in Ductile Failures	In this study, the microscopic process of ductile failure is studied by using the multi-scale simulation based on the mathematical homogenization method. According to the concept of damage is widely accepted for the continuum damage mechanics, failure process of metals is mainly governed by their microscopic voids. This study tries to simulate the process of void initiation and growth in microstructures, and shows some typical multi-scale simulations in which the macroscopic softening behaviors are related to their microscopic deformations.
Yuta INOUE	Motohiko MURAI	Study on a Distribution of a Tension along a Catenary Type Mooring Line for a Floating Body in a Test Tank	In this study I examined phase difference so that one of the problems of the mooring. I am told that phase differences between mooring tension and floating body exercise have an influence on the floating body control. I inspected this using a water tank experiment and numerical computation. I confirmed that I changed by a thing, the depth of the water that a phase difference changed with a peak by a period on the water tank experiment scale. As a result, I was able to confirm that it was necessary to consider the influence on phase difference of the depth of the water by the water tank experiment in the specific period.
Shugo OHTA	Kazumi MATSUI	A Method of Nearrby Problems for Finite Element Analysis of the Stokes Flow.	In this paper, we purpose a Method of Nearby Problems (MNP) for Finite Element analysis of the Stokes flow. MNP developed by Roy el al.is one of sophisticated verification techniques. In this approach, the setting and exact solution can be obtained by a curve fitting of the numerical solution for the target problem. We proposed an alternative procedure for the method of nearby problems by using inner product projection of the numerical solution to a continuous function for the nearby solution in the function space. In this work, we apply our approach to the problem of Stokes flow, in which incompressible constraint is imposed to the velocity field.
Kazuya OKADA	Kazumi MATSUI	Choice of Loading Conditions in Material Testing for Hyperelastic Body Based on Stress Analysis	In general, mechanical property of material in numerical simulations are determined from results of several material testing 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.

Shinichi OCHIAI	Takahiro YAMADA	Macroscopic characterization of polycrystals with grain boundary sliding	In this research, stick and slip behaviors on grain boundaries are simulated by using the multi-scale modeling method, to express the Inverse-Hall-Patch relationships. The general strength of polycrystallines depends on their representative size of grains, not only the increasing (H.P. relation), but also the decreasing of the strength have been widely accepted in nowadays. To simulate the inverse relationships without any size parameters, mechanics on grain boundaries are focused and modeled in the context of multi-scale simulation method.
Taro KANKYO	Hanako JOUHOU	A Study of Friction Vibration and Noise of Wet Clutches	Gears of automatic transmissions are shifted with friction force of a multiplate wet clutch. In the wet friction clutch, undesirable vibration and noise can occur when gears are shifted. In this study, an experimental setup to focus on clutch plates and a transmitting shaft in a wet clutch system was designed and the generation mechanism of the friction vibration and noise was investigated. The Separator plate acceleration waveform like damped free vibration of around 170 Hz and the sudden increase of sound pressure of around 950 Hz were observed just after the contact state between the separator and friction plates transiting from the stick to the slip state.
Shunsuke KURODA	Seiya UENO	The Relative Speed Control of Super Multi-link Space Manipulator to Capture Space Debris	Space debris became one of the difficulties for mankind to utilize the space environment. Among the variable efforts to the debris problem, the development of technology for the active debris removal (ADR) is especially imperative. This paper is on the motion simulation of debris capture manipulator for ADR with large number of links. In this paper, the control law to lower the relative velocity after the impact is brought in, and the results has shown almost over 80% of reduction regardless of the initial velocity of moving target debris. This will enable the system to capture the target debris more safely.
Shu KUWADA	Motohiko Murai	A Study on Electric Power for Multiple Linear Wave Energy Converter Considering the Interaction Effect	Wave power generation system is now expected as the way of utilizing marine energy efficiently. Considering the sea condition in Japan, it is advisable that we set many floating type wave energy converters in array. But now, the study of the wave energy converter is progressing mainly for single body and is not so much for plural bodies considering interaction effect. In this study, I assumed Linear wave energy converters as calculate model and researched the electric power for ones considering the interaction effect and the controlling force from linear motor. From the analysis, I could find some characteristics of wave energy converters that be set in array.

Katsuya SAIKI	Takehiro HIGUCHI	Study on Cooperative Control of Multirotors under Dynamic Constraints by Tether	This study discusses on a new control approach using dynamic property working on multirotors under tether constraint. As goods transportation method, idea of coordination transport using tether has been proposed. In this study, this idea is newly applied in the field of multirotor. In cooperative flight, aircrafts require the input to cancel each other's tension. This study derives the force to consider for stable flight from the dynamic relation working on multirotors and verifies through experiment and simulation.
Kazuki SAKAMOTO	Takahiro YAMADA	The Development of Isogeometric Analysis using T-splines among Required Line Heating	This thesis will give algorithm of automatical line heating, in which heat conditions are defined throughout the arbitrary heating path. NURBS-based isogeometric analysis, is used to improve the accuracy of curved surface. The main focus will be on use of T-splines, based on B-splines, which makes it significantly easier to treat multiple patches. This isogeometric analysis will prove to be better than for a traditional FEM for the analysed problems, by reducing the time and effort of building models.
Kazuho SATO	Seiya UENO	Study on Guidance Law for Winged Reusable Launch Vehicle with Management of Terminal Energy	This paper is on the trajectory generation of Reusable Launch Vehicle (RLV). In RLV's reentry, thruster cannot be used. Therefore, management of mechanical energy is important. To make autonomous return more reliable, this paper proposes guidance law with management of terminal energy. In this guidance law, trajectory is updated intermittently with changing terminal altitude. At this time, terminal altitude is determined by feeding back the energy. Finally, the results show that practicality of proposed guidance law is verified from the point of view of energy management.
Katsunobu SUZUKI	Ken NAKANO	Objective evaluation of operation feeling of rotary switches by hybrid velocity/torque control	With a view to understanding human touching behavior, focusing on the operation feeling of rotary switches, an experimental apparatus has been developed, which implements hybrid velocity/torque control system. Tactile information was obtained by analyzing not only output signals but also input signals.
Ryo TAKAHASHI	Kazumi MATSUI	Verification Procedure Baced on the Method of Finite Element Analysis of Hyperelastic Large Deformation Problems	Method of Nearby Problems(MNP) which is one of verification procedure have been devised. This method generates the problem with exact solutions near the target problem of interest. In this paper, nearby solution is constructed by the projection of displacement field in the deformed shape to a B-Spline function, then deformation gradient and first Piola-Kirchhoff stress is calculated to obtain external force. External force term of Nearby Problem is close to internal force of the target problem in the compressible material in the large deformation state.

Toshiki TAMURA	Takehiro HIGUCHI	Study on Guidance and Control Law of a Flying Test Bed (FTB) for Planetary Landing	Researches and developments with a Flying Test Bed (FTB) for planetary landing have been advanced to develop landing technologies needed for planetary investigations such as Moon and Mars in the future. In this study, the guidance and control law for the autonomous flight which can satisfy constraints of sensors and thruster performance has been designed and numerically simulated for the FTB flight test planned to be implemented in the second half of fiscal 2016. It can be designed guidance and control law for the FTB which has high robustness.
Wataru NAKAYASU	Seiya UENO	Study on Terminal Guidance Control Laws Based on PNG for Lunar Lander	This study focuses on guidance control for demonstration of lunar landing technology 'SLIM Project'. In power descending, feedback control law is required, which guide the lander to target precisely canceling guidance error. In this study, control laws are mainly based on Proportional Navigation Guidance (PNG). Numerical simulations show the utility as method used in terminal guidance, confirm the correspondence to the errors, and inspect the current system requirements.
Masaya HIRANO	Kazumi MATSUI	A study on correlation between macroscopic strength and grain boundary stiffness in polycrystals	The mechanical behaviors on grain boundarys are directly modeled into the conventional modeling of continuum mechanics to explain well-known Hall-Petch relations. A commonly used metal material is an aggregate of crystal grains having different crystal orientations and is called a polycrystalline material. In this polycrystalline, the material properties change due to the influence of the microscopic structure. Attention was focused that grain boundary stiffness is different from grain stiffness and modeling grain boundary element for finite element method. Consider the influence of microscopic grain boundary mechanical behavior on the macroscopic strength of polycrystalline on continuum mechanics.
Toshiki MAEDA	Toshihiko SHIRAISHI	A Study of Noise Control by Neural Networks with Dropout	This paper describes the noise control for a moving evaluation point using neural networks by making the best use of its learning ability. To obtain good control performance, it is important to precisely identify the characteristics of all sound paths at all time. In this paper, we applied neural networks with the learning ability to the noise control system to follow the time-varying paths and verified its control performance by numerical simulations. Then, dropout technique for the networks was also applied. Dropout is a technique that prevents the network from overfitting and that realizes better control performance.

Daisuke YAMAZAKI	Shin MORISHITA	Study of the gear noise characteristic by using photoelasticity technique	The high-speed photography of strain distribution in gear teeth during rotation and the gear noise were simultaneously captured by high speed camera and microphone. Gears are usually used in transmission systems, and they encounter serious problems on noise. In order to solve these problem, it is important to know the elastic deformation in gear teeth during operation. In this experiment, the photo-elasticity technique was applied for visualization of strain distribution. As a result, the sound pressure became local maximum at start and end meshing, and became local minimum before pitch point. Also the frequency analysis was affected by these points.
Takahiro YAMAMOTO	Takehiro HIGUCHI	Study on Development of Multirotor with Wind Resisting Performance	This study attempts to propose the new Multirotor to fly in the environment with wind disturbance. The wind resisting performance is relied on the hardware composed of 'Weathercock device' and 'Side thruster', which are proposed and designed newly. To use these devices properly, the software is also designed. As preparation, the motion of multirotor is calculated by simulation. This results show good response thus the verification experiment is carried out. Both results show good response, and it is figured out that these results are similar.
Tsubasa YOKOYAMA	Takehiro HIGUCHI	Study on Development of New Multirotor for Offshore Operation	This study discusses on development of multirotor that is able to generate electricity with wave power. Some multirotors are used various places and purpose, but it is necessary to change the battery because it is limited flight time. The new multirotor is proposed and developed. In this study, it is equipped with measuring device that measures wave power so it is not the case that a new generator is developed. It is experimented measuring wave power and calculate energy with a water tank in my university. Also, the simulation display control of detached water is considered viscous frictional forth, when multirotor detached water on this side becoming maximum tilt angle.
Hisaki YOSHIOKA	Motohiko MURAI	Experimental study on interaction among air amount,nozzle opening ratio and water surface elevation in semi-submersible column with nozzle	Many wave tank experiments have been conducted in research on oscillating water column (OWC) type wave power generator. In a wave tank experiment, attention is paid to nozzle opening ratio and water column draft as parameters related to primary conversion performance. However, in the wave tank experiments, since the physical property values of air in the OWC are different, there is a possibility that the performance of the actual machine can not be evaluated correctly. Therefore, in this study, we examined whether the internal air volume can be a new parameter in model experiments, based on experiments and numerical calculations.

Ryo Fukushima	Motohiko Murai	A Study on Viscous Drift Force on Splash Zone of Semisubmergibles	In designing the mooring system of semisubmersibles, which develop offshore gas fields, viscous drift force on splash zone of colums of them is important because it is noticeable under higher and longer wave condition. In this paper, we provide methods to calculate viscous drift force and compare surge motion of calculation and that of model experiment in wave tank to select the best method. We estimate an increment of drift force by using the new method and redesign mooring lines to survive.
Yoshifumi NAKA	Takehiro HIGUCHI	Study on Singular Inputs for Minimum Time Maneuver of a Satellite with CMGs	Control moment gyro (CMG) is device used as an actuator for attitude control of spacecraft and provides high agility. This paper discusses on the minimum time maneuver from viewpoint of optimal control with CMGs. According to optimal control theory, bang-bang control is optimal in most of the inputs for minimum time maneuver. However, some data did not such a result where an input. These intermediate inputs are called the singular inputs. In this paper, we suggest a new model with a CMG with controllable angular momentum in the CMG with the singular input. The new model has shown faster maneuver more than 15 % in some of the cases.