Keio Graduate School of System Design and Management

Designs the Future

URL: http://www.sdm.keio.ac.jp















Faculties and Research Fields:
System Design & Management
Keio University

- *Haruyama, Shinichiro* haruyama@sdm.keio.ac.jp
  - **Ubiquitous Communication Laboratory**
- *Hibiya, Taketoshi* t.hibiya@sdm.keio.ac.jp
  - **Science and Technology System Laboratory**
- *Kohtake, Naohiko* kohtake@sdm.keio.ac.jp
  - **Aerospace and Intelligent Systems Laboratory**
- *Maeno, Takashi* maeno@sdm.keio.ac.jp
  - **Human System Design Laboratory**
- *Nakano, Masaru* m.nakano@sdm.keio.ac.jp
  - **Business Engineering Laboratory**
- *Nishimura, Hidekazu* h.nishimura@sdm.keio.ac.jp
  - **Control System Design & Dynamics Laboratory**
- *Ogi, Tetsuro* ogi@sdm.keio.ac.jp
  - **Visual Simulation Laboratory (VS–Lab.)**
- *Ohkami, Yoshiaki* ohkami@sdm.keio.ac.jp
  & Urago, Masataka m.urago@sdm.keio.ac.jp
  - **Strategic Design Laboratory**
- *Sasaki, Shoichi* s.sasaki@sdm.keio.ac.jp
  - **Environmental & Symbiotic System Design Laboratory**
- *Shimazu, Keiko* shimazu@sdm.keio.ac.jp
  - **Information Systems Perspective Investigation and Requirement Engineering Laboratory (INSPIRE Lab)**
- *Takano, Kenichi* k.takano@sdm.keio.ac.jp
  - **Management of Organizational Behavior Laboratory (MOBIL)**
- *Teshima, Ryuichi* r.teshima@sdm.keio.ac.jp
  - **Socio-Critical System Laboratory (SCS)**
- *Toma, Tetsuya* t.toma@sdm.keio.ac.jp
  - **Communication Design & Management Laboratory (CDM)**

Ubiquitous Communication Laboratory

Shinichiro Haruyama, Professor

Graduate School of System Design and Management, Keio University

Human-Centered Design for Ubiquitous Communication Society

In a ubiquitous communication society in the future, people will be able to communicate anywhere at any time. In the Ubiquitous Communication Laboratory, we are investigating truly useful service in such a ubiquitous society such as new telecommunication system, location-based service, man-machine interface, augmented reality, integrated circuit design, and new software development technique, etc.

Examples of recent research results are shown below:

◎ Robot position control using LED lighting (Figure 1)

Ubiquitous Communication laboratory developed a technology that can control robot movement with an accurate position detection by sending position data from LED light that will be used in most homes and offices in the future. The accuracy of a robot position using this method is about 1cm when the LED light is attached to a ceiling at two meters from the floor. This technology can be used for a wide variety of applications, including an automatic navigation of a patient on a wheel chair in a hospital.

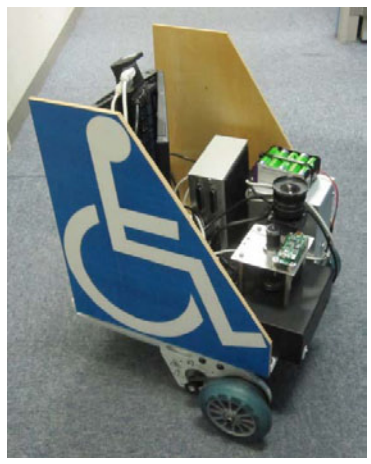

Figure 1: Robot position control using LED lighting

◎ Highly Accurate Three Dimensional Position Measurement Technology (Figure 2)

Ubiquitous Communication Laboratory developed highly accurate three dimensional Position Measurement Technology using visible light communication and photogrammetry technique in cooperation with Mitsui Sumitomo Construction Ltd. The new technology makes it possible to do an accurate measurement automatically with low cost even at night. The accuracy of measurement is 1mm resolution when the measured object is in the range of about 40m×40m. Japan Society of Civil Engineers chose this technology as one of ten civil engineering innovation in 2009.

Figure 2: Highly Accurate Three Dimensional Position Measurement Technology

◎ High-Speed Communication Technology for a High-Speed Train (Figure 3)

Internet services by JR Tokai began serving in 2009. It is expected that there will be a great demand for high speed communication for passengers who want to use high speed internet services such as Youtube or Ustream. The data rate which is several thousand times higher than current speed may be needed. Ubiquitous Communication Laboratory has been doing a joint research with Railway Technical Research Institute of JR since 2004, and we succeeded in experimenting on a high-speed communication of about one gigabit per second between the moving Shinkansen bullet train body and the ground.

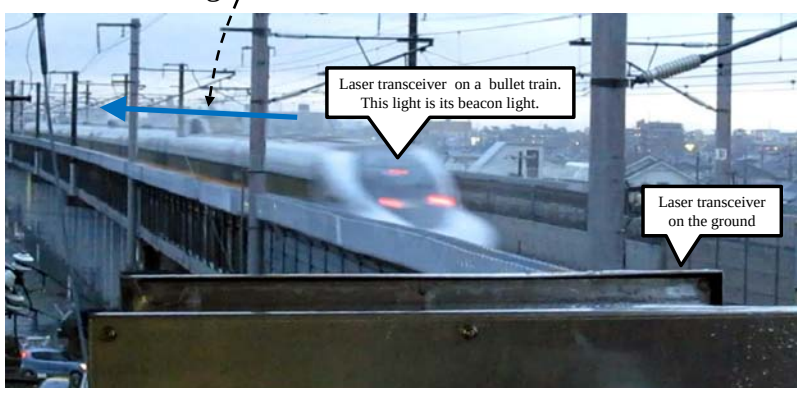

Figure 3: High-Speed Communication Technology for a High-Speed Train

Science and Technology System Laboratory

Taketoshi HIBIYA , Professor

Graduate School of System Design and Management, Keio University

t.hibiya_at_sdm.keio.ac.jp

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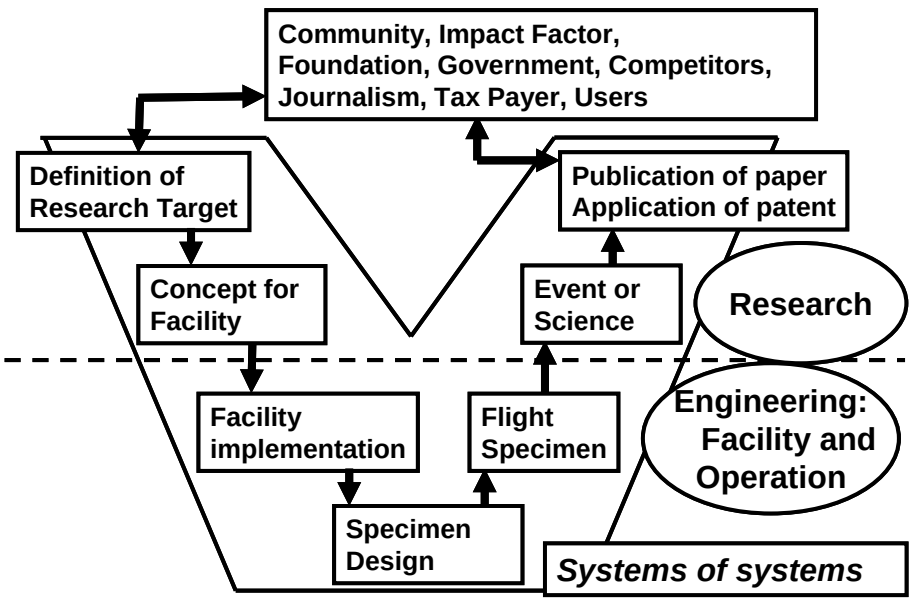
Philosophy of research activity

1. Research on system consisting of human and science and technology
2. Safe and secure management of project
3. Analysis using ∇ model

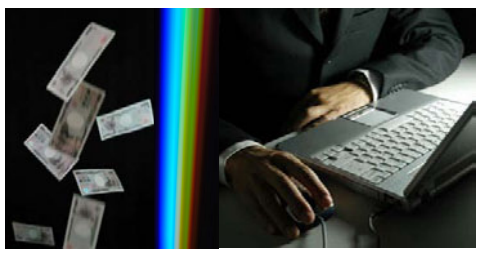
Research topics in our lab.



Nabla (Vee) model for space experiment analysis

Analysis on microgravity experiment project

Designing complex data Data center for the next generation



New business created by a cutting edge technology

Hung-Chi HSIAO

TSMC

PhD student from industry

I am studying a business model of semiconductor industries for a new era. Open innovation is essential, i.e., collaboration among “IDM Companies”, “Fabless Companies” and “Foundry”.

Shinya AKIZAWA

Attorney in US

PhD student

As an attorney, I have worked in the filed of legal issues, in particular of intellectual property. Also I am teaching in a MBA course of some universities. I am continuously stimulated by colleagues at the first graduate school in Japan designed by a new concept.

Hiroaki DAIGO

Sony Corporation

PhD student from industry

I wish to make a research on standardization of a technology using a nabla model. I hope that my visual display can be a winner in the market.

Jiro FUKUDA

Mitsubishi Research Institute

PhD student from industry

I am involved in research on systematic design for the “internet data center” for the next generation, so that we can reduce energy consumption and environmental burden. Use of exhaust heat is essential.

Graduate: Hideki FUJII

MS students: Dr. Kazuya HIROSE, Keigo KAKIKURA

Aerospace and Intelligent Systems Laboratory

Naohiko KOHTAKE, Associate Professor

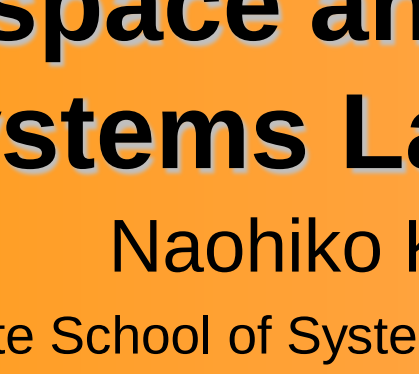
Graduate School of System Design and Management, Keio University

System Design and Management from Aerospace System through Daily Life

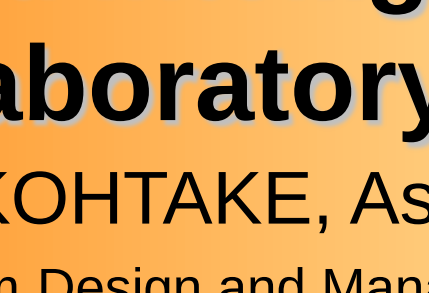
Introduction

The Aerospace Intelligent Systems Lab (AIS Lab.) of the SMD Institute, Graduate School of system Design and Management, makes its cornerstone the research into the interaction of physical space and virtual space. Research is tackled with the purpose of establishing this interaction in a broad range of systems, from aerospace systems to those intimately related with daily life, and to give the results back to the real world. In addition to technical research, investigations are also advanced into value creation in society and business feasibility, with the purpose of the study to constantly propose new products, services and structures from the perspective of the user. We welcome persons who aspire to have an ability in design and system management with respect to the system life-cycles, and persons who wish to apply such abilities in the real world. As any kind of system consists of wide-ranging basic technologies, the attitude to independently study and master the knowledge and techniques necessary for any purpose is strongly stressed.

Observation



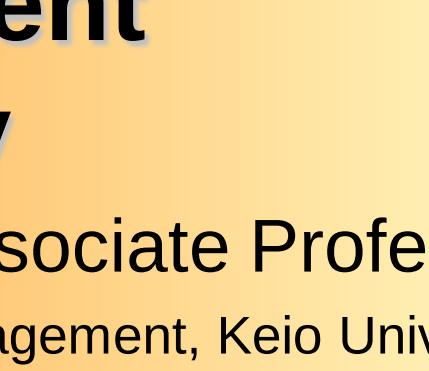
Workshop



Project Duration		10
Initial Investment Cost		¥10,000,000
IMES Unit Price		¥150,000
IMES Unit Price Decrease Rate		20.0%
Initial Number of IMES		100
IMES Installation Cost	/IMES Unit	¥10,000
IMES Installation Increase Rate		30.0%
Initial Customer		1,000
Customer Increase Rate		50.0%
IMES Service Price	/Customer	¥300
IMES Electricity Cost	/IMES Unit	¥23
IMES Maintenance Cost	/IMES Unit	¥3,000
IMES Marketing Cost	/Added Customer	¥3,000
Margin to Building Owner	/IMES Unit/Year	¥10,000
Administration Cost		10%
Depreciation	Fixed	10
TAX		40%
WACC		10%
Interest Rate		5%

NPV	¥84,868,047
IRR	28%

Business Simulation



Test and Analysis

Prototyping

Demonstration

Practical Experiments

Asia-Pacific Regional Space Agency Forum

Main Research Activities

Faculties

- Naohiko Kohtake, Associate Professor, Ph.D. in Media and Governance
- Nobuaki Minato, Assistant Professor, Aerospace MBA
- Sun K. Kim, Assistant Professor, Ph.D. in Mechanical Engineering

Student (Master's and Doctoral Courses) / Researcher Applications

The AIS Lab is a new laboratory that was launched in September 2009. Through the application of System Design Management, research is implemented to create innovation in response to the needs of society. It is possible to participate as an AIS Lab researcher as a student or non-student, please contact us if you have interest in independent creation.

Contact

http://aislab.sdm.keio.ac.jp/ mailto:kohtake@sdm.keio.ac.jp

Human System Design Laboratory

Takashi Maeno, Professor

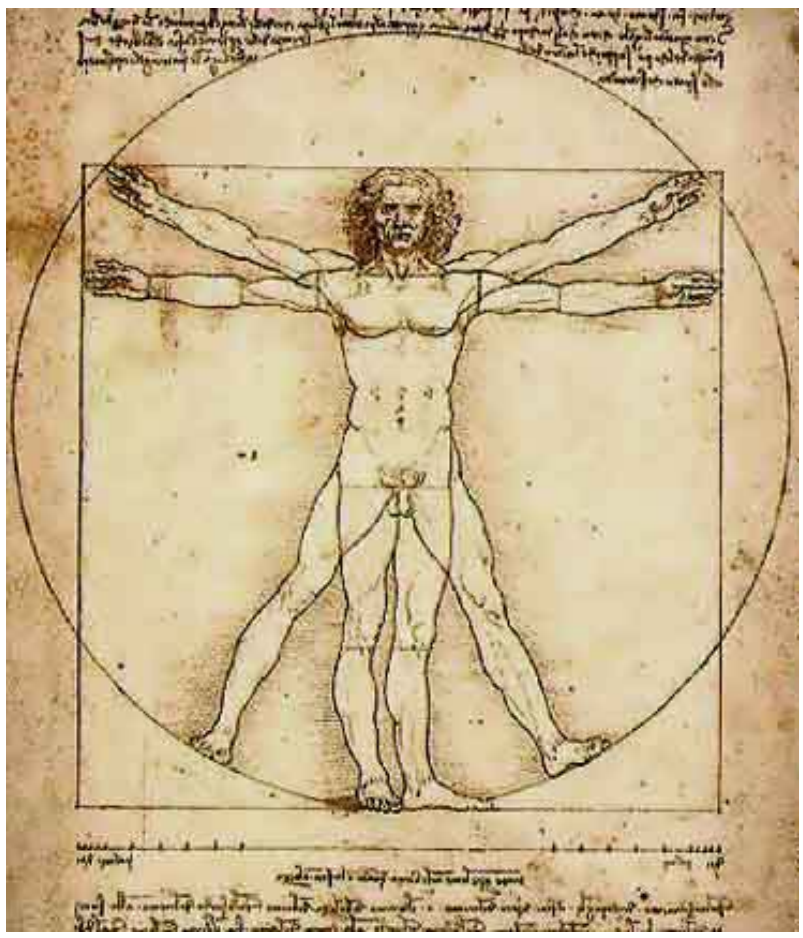
Graduate School of System Design and Management, Keio University

Our goal is to understand and develop systems in relation to human beings. In one hand, we analyze humans as systems. What is phenomenal consciousness? What is “happiness”? How philosophy of organization should be? Those questions are in relation from philosophy to sociology. On the other hand, we develop human-machine systems including robots and tele-operating systems. Those researches are in relation to mechanical and information engineering. Research field of our lab widely explore, however, what is important is the same. We try to analyze and develop things important for humans. How can we find out what is important? They can be found throughout requirement analysis utilizing various methods taught in our graduate school of System Design and Management, Keio University.

Research topics in Human System Design Lab

What is “happiness” and how “happiness” in relation to values including economical and psychological values?

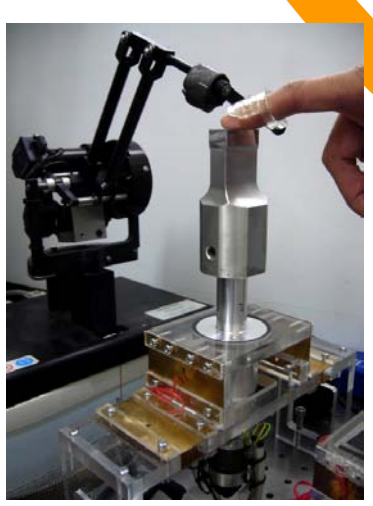
Ethics study. Ethics is a discipline of “values”. Hence, how we should live is a question on ethics.



How can we make artificial systems “life-like”? Especially, can we make systems “happy” similarly with humans?

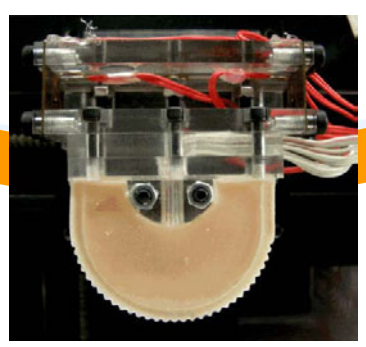
How organization should be? And at the same tile, how individual in the organization should be? Human society study.

Tactile display using ultrasonic vibrator and force display

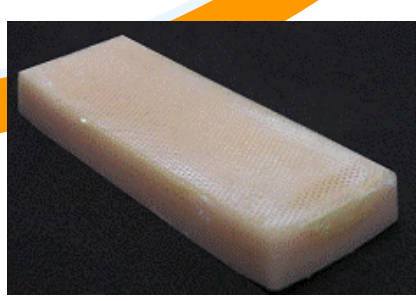


Miniature robot hand using shape memory alloy

Tactile sensor for estimating texture of products



Artificial skin having texture and softness similar to human’s skin



Five-fingered 20 DOF robot hand using twenty ultrasonic motors

Business Engineering Laboratory

Masaru Nakano, Professor

Graduate School of System Design and Management, Keio University

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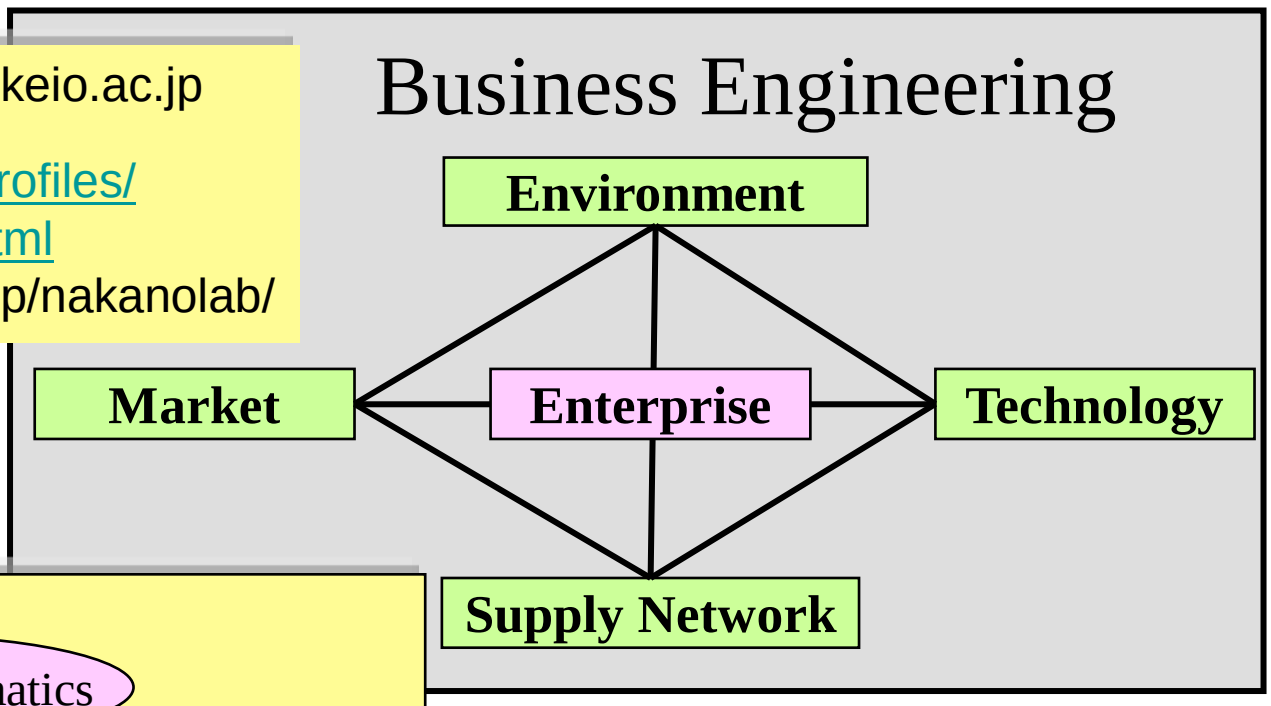
(Replace "_at_" with "@")
- http://k-ris.keio.ac.jp/Profiles/0233/0017045/prof_e.html
- http://lab.sdm.keio.ac.jp/nakanolab/



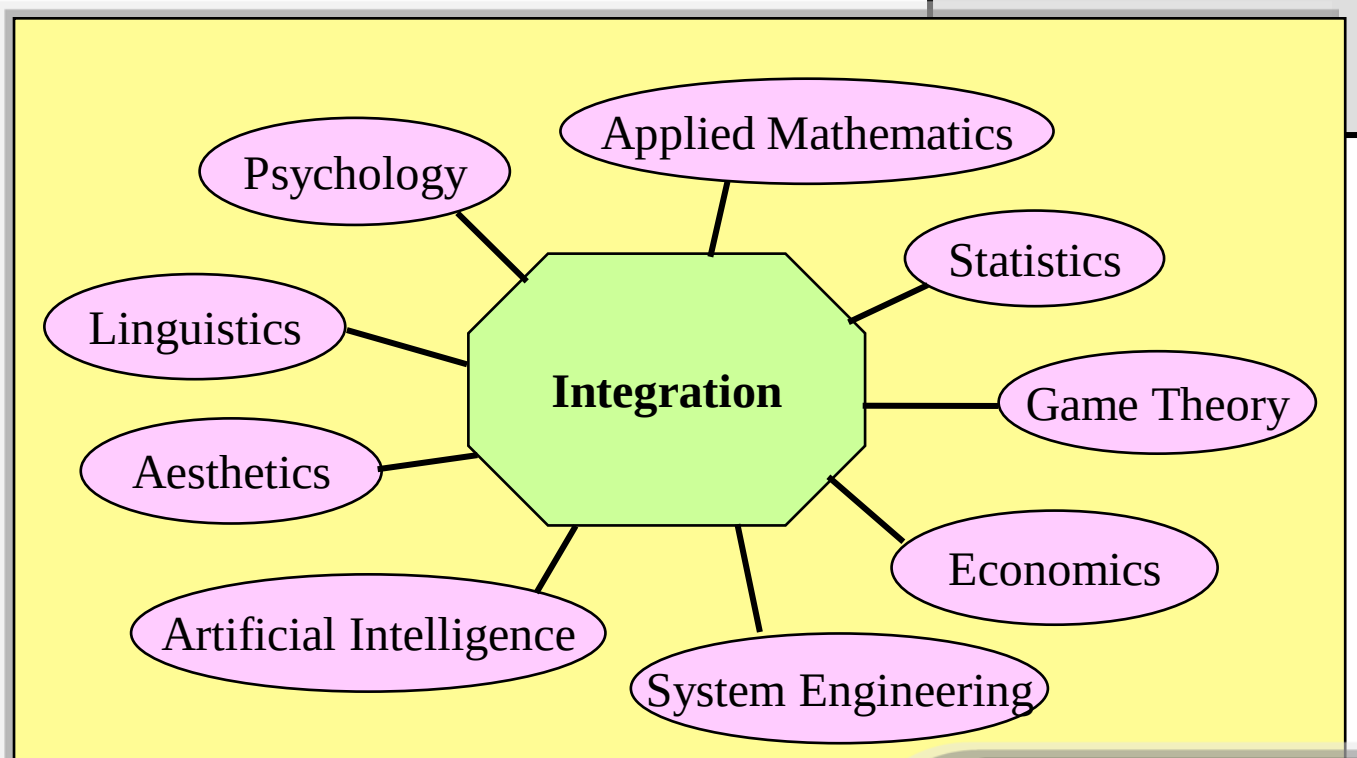


Figure 1. Basic Technology for Business Engineering

Research Areas

A. System Design for Environment
B. Enterprise Integration and Supply Network
C. Enterprise Risk Management
D. Marketing and Value Chain Analysis
E. Management of Technology Development
F. Business Process Reengineering
G. New Mobility System for Aging People
H. Energy Security in East Asia Region

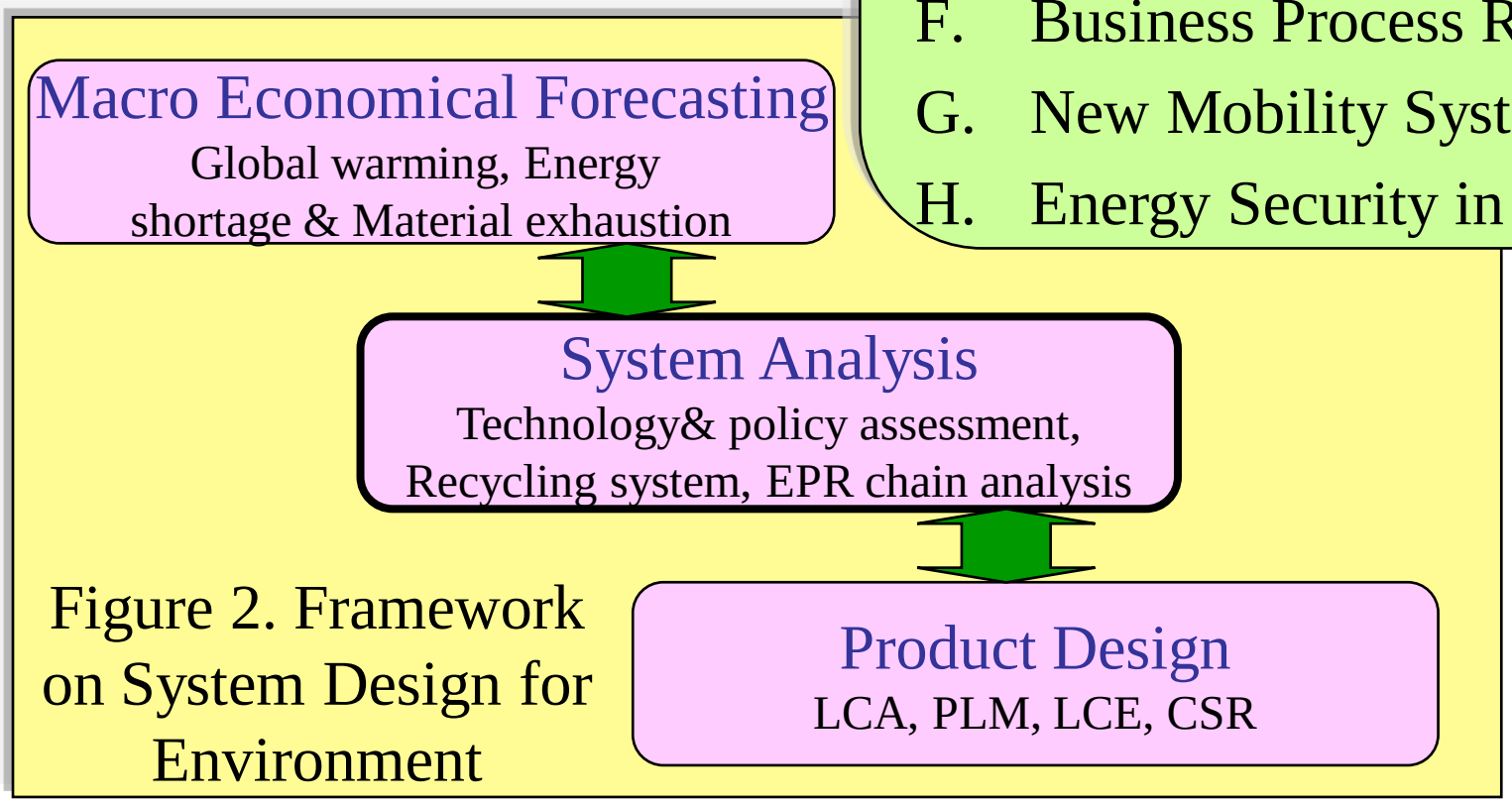


Figure 2. Framework on System Design for Environment

Control System Design & Dynamics Laboratory

Hidekazu Nishimura, Professor

Graduate School of System Design and Management, Keio University

We are developing various systems to create a safety and symbiosis society for the people, and designing the system of systems by grasping the demand of the people and understanding dynamics of the system.
Our laboratory's homepage ---- http://lab.sdm.keio.ac.jp/nismlab/

◆ Integrated System Design for Vehicles Motion Control

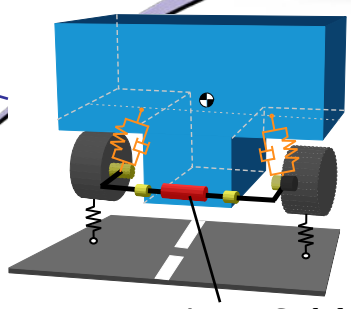
In order to improve driving stability of vehicles (automobiles or motorcycles), we design the integrated system for the driving assist control. Taking low environmental load and prevention safety into account, we design the vehicles control system for drivers or riders to drive the vehicles staying stress-free.

◆Vehicles Collision Safety System

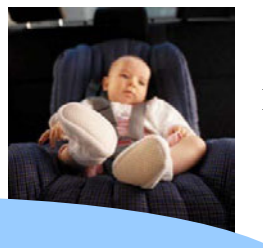
In order to minimize the injury risk of the occupant in vehicle collision, we propose the collision safety system of the next-generation. We thrash out problem with the current system on the basis of the real accident data and aim at the further improvement for the safety.

System Design

MATLAB/Simulink **BikeSim**



Active Stabilizer

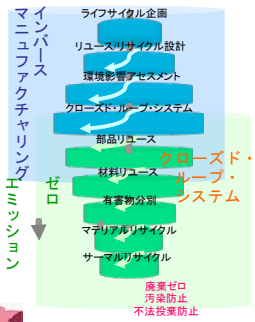


MADYMO

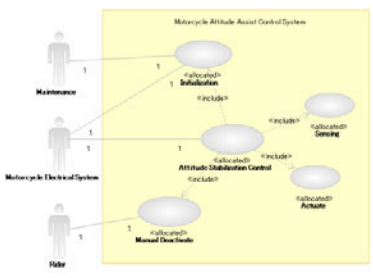
Design of Next-Generation Active Dummy

Safety and Symbiosis

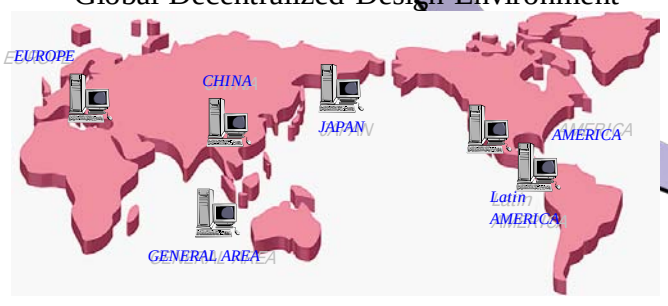
Dynamics



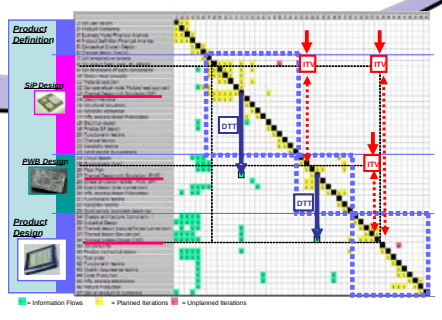
Use Case Diagram



Global Decentralized Design Environment



Design Structure Matrix



Seismic Response Control

SysML, SimulationX

Modeling

◆ System Design Approach for Fewer Design Iteration

We propose the new approach for the distributed design project that enables design optimization of product life cycle behavior (performance, cost, and environmental load, etc.). By using various modeling technologies such as SysML and numerical simulations, we develop competitive product design methodology for consumer electronics that realizes new value innovation.

◆ Model-Driven System Development

We build the systematic approach of the model-driven system development (MDSD) according to the V model and promote the system design for fewer design iteration. Also we construct HILS/SILS to contribute to the system development utilizing the simulation environment.

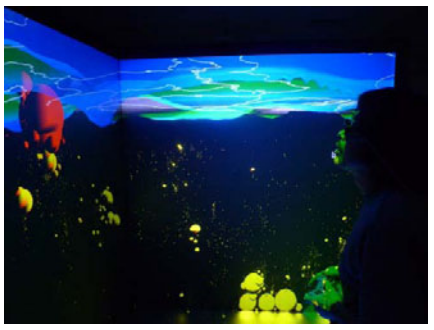
Hardware/Software In the Loop Simulation

Visual Simulation Laboratory (VS-Lab.)

Tetsuro Ogi, Professor

Graduate School of System Design and Management, Keio University

Visualize



Visualization of seismic data

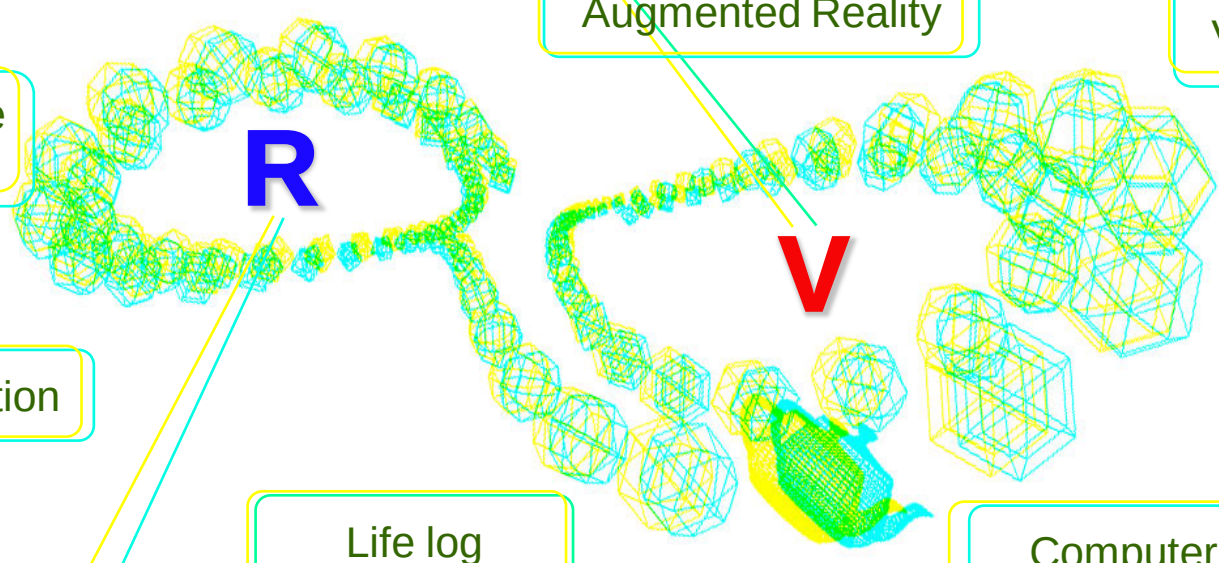
Visualization of flow field data

Immersive projection display: K-Cave

http://lab.sdm.keio.ac.jp/ogi/

What is VS-Lab ?

VS-Lab carries out research towards the development of new simulation and media technology by integrating virtual reality, high-speed network and high performance computing, etc.
The recent research focuses on visual simulation, visual data mining and tele-immersive communication using the networked immersive projection display (CAVE) and super-high definition display (4K stereo projector).



Augmented Reality

Visualization

High Performance Computing

Virtual Reality

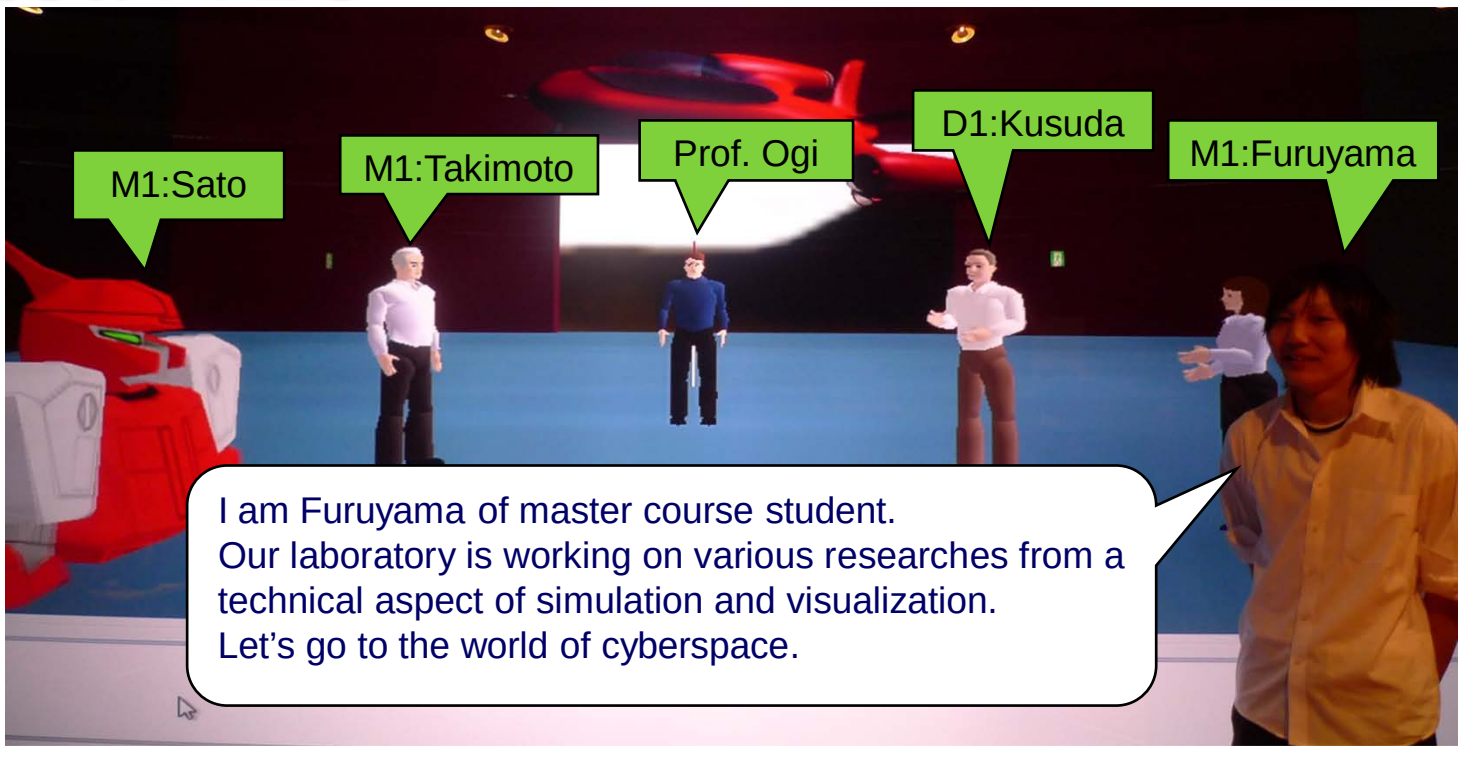
Visual Simulation

Visual Data Mining

Life log

Computer Graphics

Realize



Tetsuro Ogi

Strategic Design Laboratory

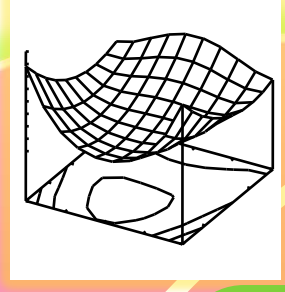
Delightful systems are designed by our mixed team; across age, specialty and culture.

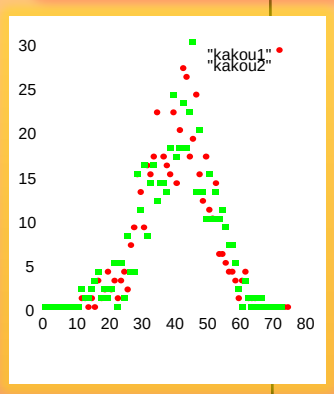
Yoshiaki Ohkami, Professor
Masataka Urago, Associate Professor
Graduate School of System Design and Management, Keio University

From the viewpoint of strategic systems engineering

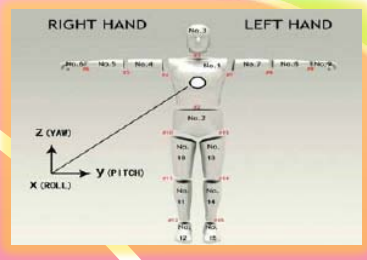
Our purpose is to satisfy user needs by requirement analysis and simple system design. We pay attention to the forest for the tree of a system.

Human and nature



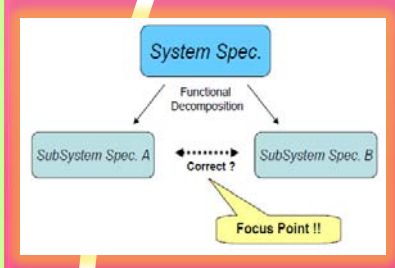


Kayo Ph.D cand.
Multibody dynamics of human body



Mokuno Ph.D cand.
Rendezvous Docking system

Iwasaki
Human resource Management



A. Prof. Urago
Modeling and simulation of large scale system optimization

Engineering

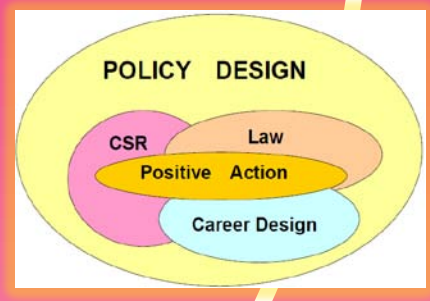
Kato Ph.D cand.
Software IV & V

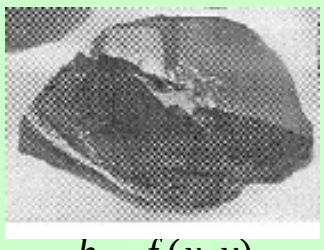
Kimura Ph.D cand.
Revitalization of rural areas

Social aspect

Daigo
Sub-orbital spaceship and its horizontal takeoff system from sea

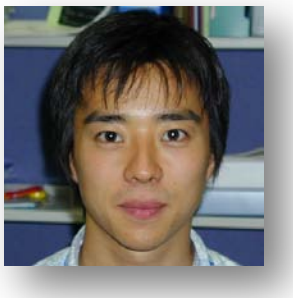
Prof. Ohkami
Dynamics and control of large scale systems



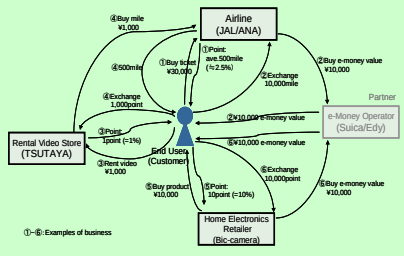


$$h = f(x, y)$$

Ohsaki
Shape measurement of rigid object from image



Miyake Ph.D cand.
Measurement systems



Social life

Environmental & Symbiotic System Design Laboratory

Shoichi SASAKI, Professor

Graduate School of System Design and Management, Keio University

1. introduction

- To design a environmental and symbiotic system, such as vehicles, agriculture, and energy system.
- To educate persons capable for.

2. idea

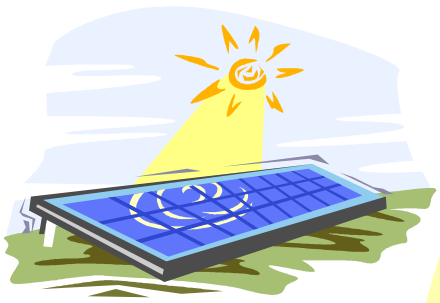
To realize the environmental & symbiotic society through proposals of a new social and technical system, comprised of energy, agriculture, and vehicles

3. mission

- propose new systems through the verification of multi view point
- create a free and open-minded activity in our study

Shoichi SASAKI, Professor

4. Field of Study



Energy

Natural energy

Biomass plantation

Well to Wheel analysis

LCA (Life Cycle Assesment)

Network of power plug

Inter industry Relation table

Large scale energy system

City village co-operation

Melting pot

Plug-in hybrid vehicle

Multi value analysis of agriculture

Hybrid vehicle

Fuelcell Vehicle

Electric vehicle

Business process in agriculture

Agriculture

Vehicle

Yasuhiro Matsuo（M1 ）

Theme：Analysis and proposals on the agriculture from the business view

objective：to solve the business issue on the agriculture, and to make an effective proposals

Takeshi Ohotsuka（M1 ）

Theme：*Multi value analysis of agriculture in the city*

objective ： to establish the method of analysis and evaluation for the agriculture especially in the city

Shintaro Murakami（D1）

Theme：Next generation power system for the vehicle application

objective ：to propose the new electric power system in the future vehicle from the point of reliability and efficiency

Emiko Tsuji（M1 ）

Theme：establishment of total evaluation method for the symbiotic vehicle

objective ：to establish the concept and evaluation method for the symbiotic vehicles, using Well to Wheel analysis

Seiichi Tabata（M1 ）

Theme：study on the social system for the plug-in hybrid vehicle

objective to clarify the suitable power distribution system, through the study of optimization for an plug-in hybrid vehicle

Takashi Yamamoto（M1 ）

Theme：Nest generation biomass energy system based on the city and agricultural district

objective ： to establish the sustainable biomass energy system in the city and agricultural district from the view of co-operaton between them

Toshiyuki Seto（M1 ）

Theme：LCA Analysis for the oversea energy plantation

objective ： to establish the oversea biomass energy plantation system by comparison of several plant based on the near term technology, using LCA technique

Information Systems Perspective Investigation and Requirement Engineering Laboratory (INSPIRE Lab)

Keiko SHIMAZU, Associate Professor

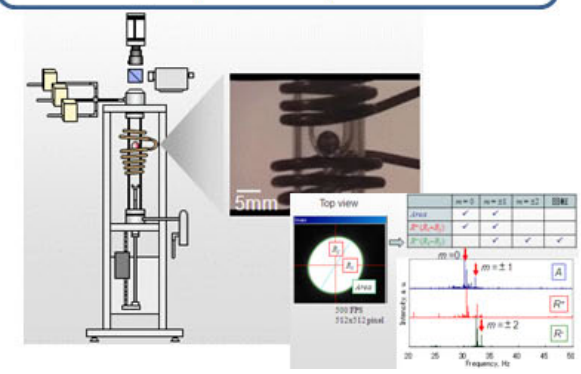
Graduate School of System Design and Management, Keio University

- Systems Engineering frameworks and methodologies, established through large-scale and complex hardware systems projects, ensure the optimum systems operation based on high quality security and stability. In our laboratory, we are aiming to apply and enhance them for information systems engineering.

- Currently, modeling methodology has become one of the most important issues in systems engineering, same as information systems developing. For instance, ER (Entity Relationship) and OO (Object Oriented) modeling, proposed information science field, have been adapted to hardware systems developing.

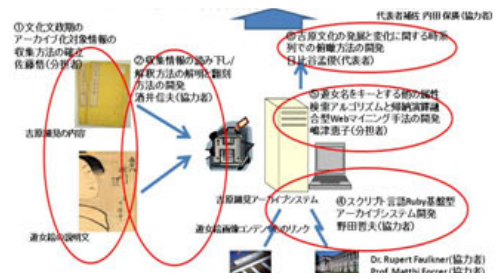
- Therefore, we try to develop novel framework or modeling methodology for information systems engineering, especially for systems requirement development, system architecture consistency checking and systems interface design. Our field covers not only software but also hardware, human-ware, and their interfaces.

Information Systems for Physical Experiment



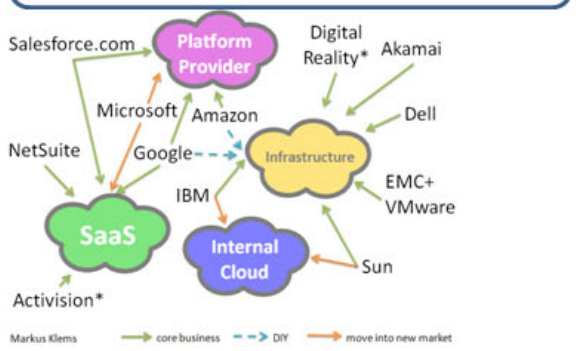
Sponsored by JST (Japan Science and Technology Agency)

Information Architecture for interacting with each UKIYOE (浮世絵) database all over the world



Sponsored by Grants-in-Aid for Science Research

Information Systems on Could Architecture



[Markus klems, Merit in Cloud, Cloudy Times, http://markusklems.wordpress.com/, October1, 2007]

Model Theory

$I \models S$

$I \models_t S$

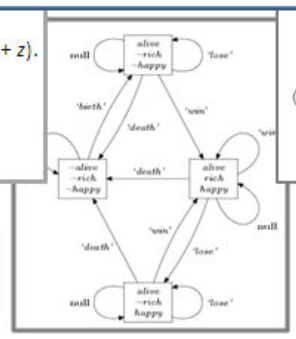
$\forall x \forall y \forall z\,(x + (y + z) = (x + y) + z).$

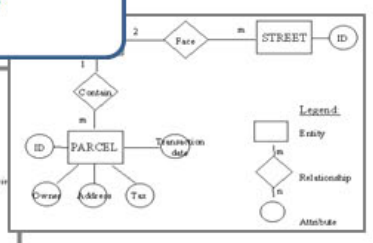
$\forall x\,(x + 0 = x).$

$\forall x\,(x + (-x) = 0).$

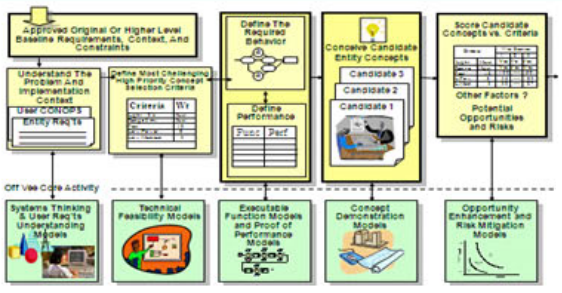
$\forall x \forall y\,(x + y = y + x).$

$\exists\, xSx \rightarrow \exists\, xFx$



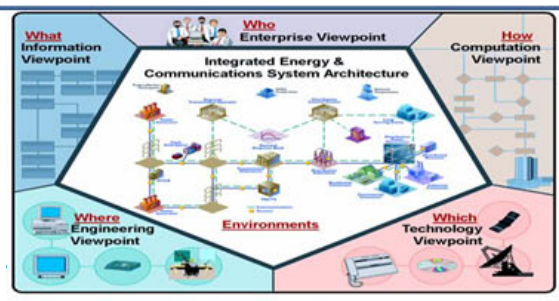


Requirement Development in Systems Engineering



[Hal Mooz, The Dual Vee-Tutorial, http://www.intelligrid.info/HTML/IECSA VolumeIV.htm, October1, 2007]

Systems Architecting for Consistency



[Joe Hughes, The Integrated Energy and Communication Systems, Architecture, http://www.intelligrid.info/IntelliGrid_Architecture/IECSA_Volumes/IECSA_VolumeI_AppendixB.pdf, October1, 2007]

Management of Organizational Behavior Laboratory (MOBIL)

Kenichi Takano, Professor

Graduate School of System Design and Management, Keio University

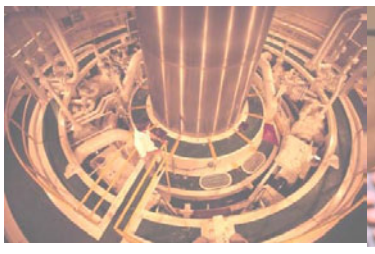
Creating Vital Human beings and Organizations

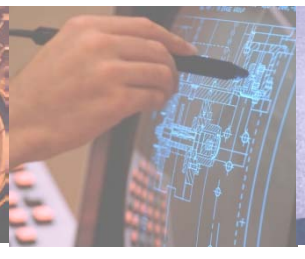
MOBIL have been making an efforts and challenge to create “Safe and Secure Society and Organizations for every Human being” by employing diverse methodologies.

An intensive research is continuing how to reengineer old fashioned organizational frames and social systems how to establish vital and reasonable organizations and how to change culture not to commit compliance problems and accidents by the corporation with young students and/or experienced students.

Even today, there were various problems to be solved due to conservative culture, work practices, inappropriate rules and procedures, excessive regulations. MOBIL puts on importance not only on safety management and risk assessment but also on culture and climate in organizations, such as safety culture. (see right hand side figure).

Above is the eight components supporting organizational safety culture, that is essential to keep sound organizations for the future





～Outlines of our research area

- Prevention Strategies to Eliminate Industrial Accidents and Incidents (Organizational Study ・Management ・Quality Assurance of Software)
- Increase Motivation for Individuals ・Teams・Organizations （Leadership ・Motivation ・Socio Technology)
- Revolution and Creation of Industrial Culture (Corporate Value ・Safety Culture ・Management of Technology)
- Creativity and Sensitivity Development for Engineers (Human Factors ・Kasei Engineering ・Education and Training)

Socio-Critical System : SCS

Ryuichi Teshima, Professor
Graduate School of System Design and Management, Keio University

Failure of System

Failure of Socio-Critical System: CSC in Japan came to a stage where it should not be overlooked in the light of interests of our country and has become a cause of deterioration in our country's competitiveness.

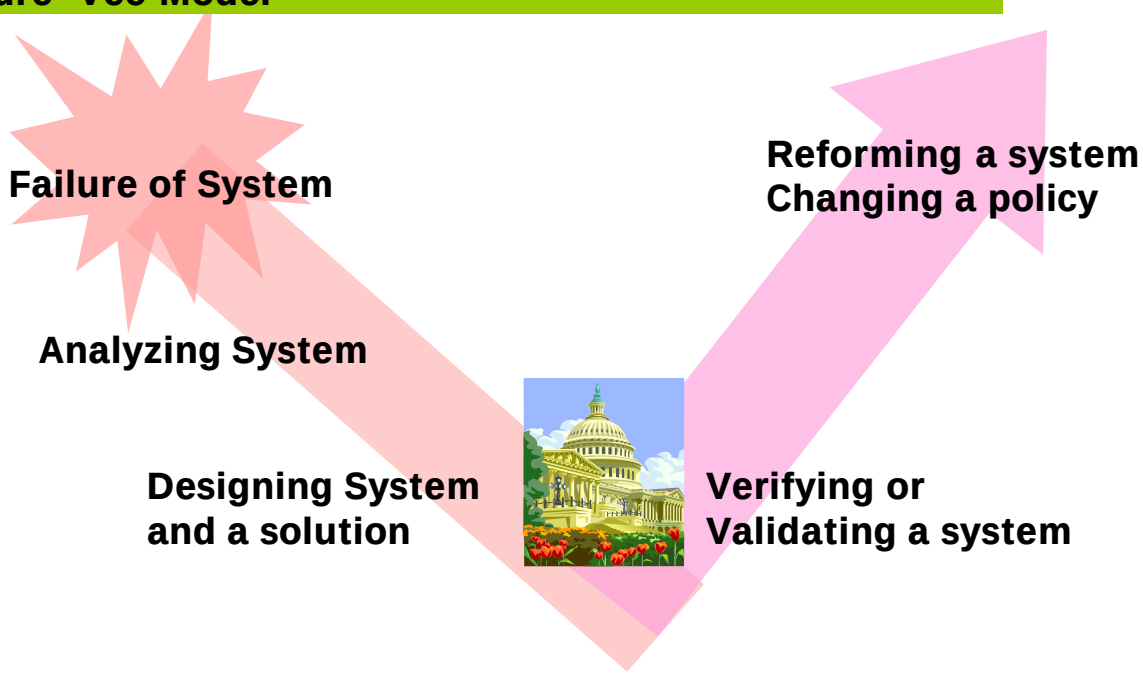
For example;
-Sudden unexpected suspension of public system
-Failure to catch up with the speed of development of new medicines
-Massive scale of failure in developing a system
-Failure to catch up with global competition in a display market

…etc

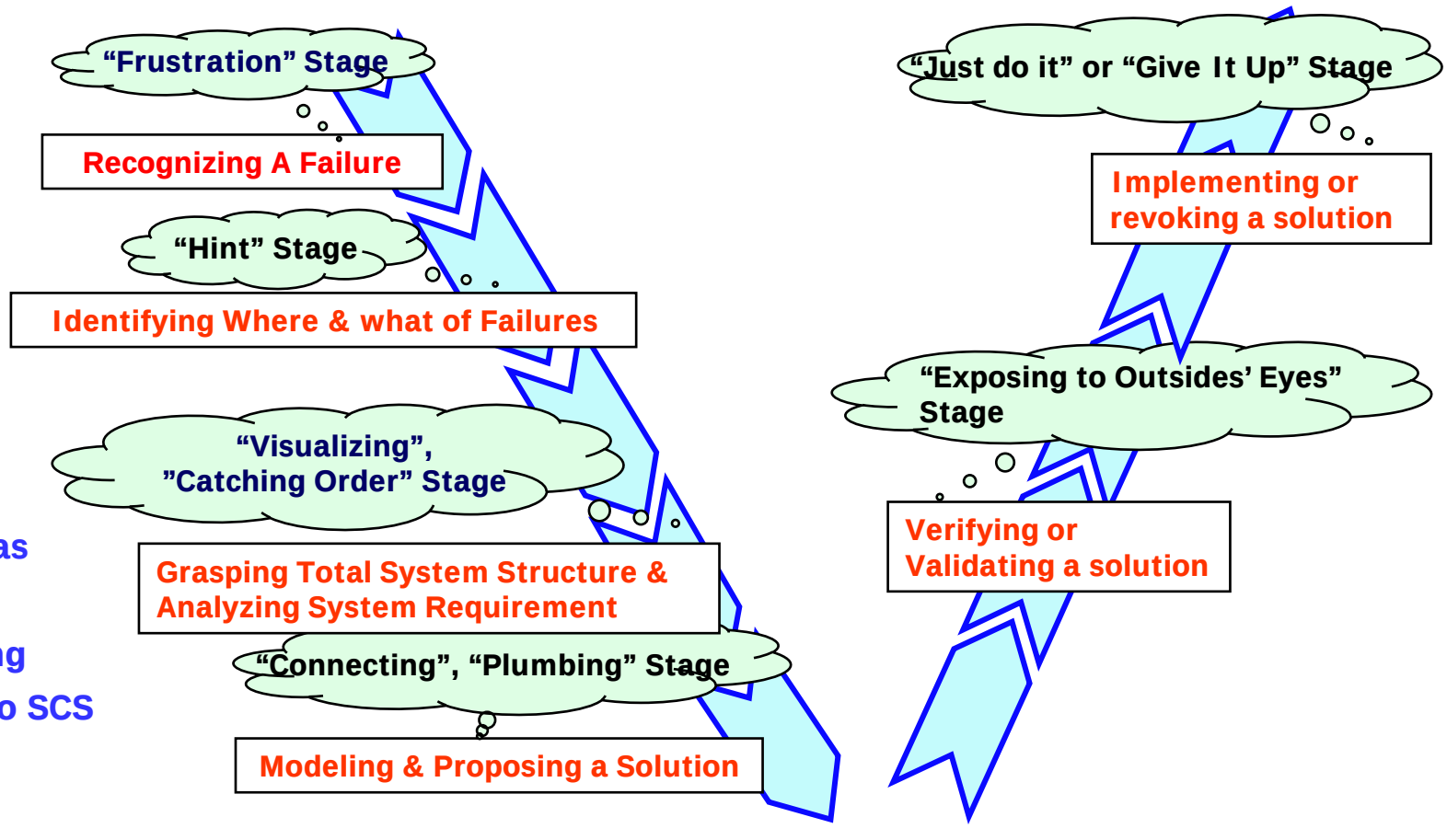
■Design Project of Socio-Critical System : SCS

-Comprehensive Approach (Politics, Economy, Intelligence, International Security)
-Failure of SCS ; examples
-Solution by Applying Architecture Vee Model

Themes:
Introduction to International Affairs,
Business Intelligence
(e.g. International Security, hegemony, power, currency, global financial market, trade ,etc)



Applying Architecture Vee Model to a Socio-Critical System



First Systematic as well as Demonstrative Study of system failure by applying architecture Vee Model to SCS in Japan

Communication Design & Management Laboratory

Tetsuya TOMA, Associate Professor

Graduate School of System Design and Management, Keio University

Real Time HD Communication System for Telemedicine Using GI-POF

Objective

Recent ICT technology advancement makes us easier to communicate through video between distant locations. Telemedicine using such technologies has been increasing its expectations more and more. To enhance its efficiency, picture quality is quite important. High-definition video format is becoming common, but it requires data compression to send it to the other side. Our hypothesis is that the communication delay and picture noises caused by the compression process bother doctors to diagnose patients. To prove the hypothesis, we conducted telemedicine experiments at Suginami Medical Association in Tokyo comparing conventional communication systems with our proposed system using Graded Index Plastic Optical Fiber (GI-POF) and HDV-OTR® Media Converter to send the HDMI video directly without compression.

AS IS

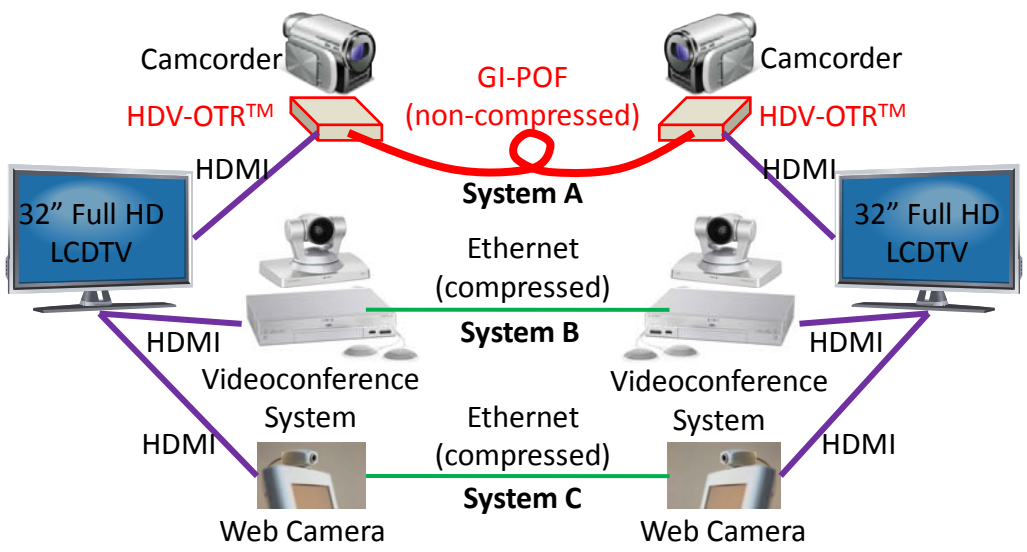
TO BE

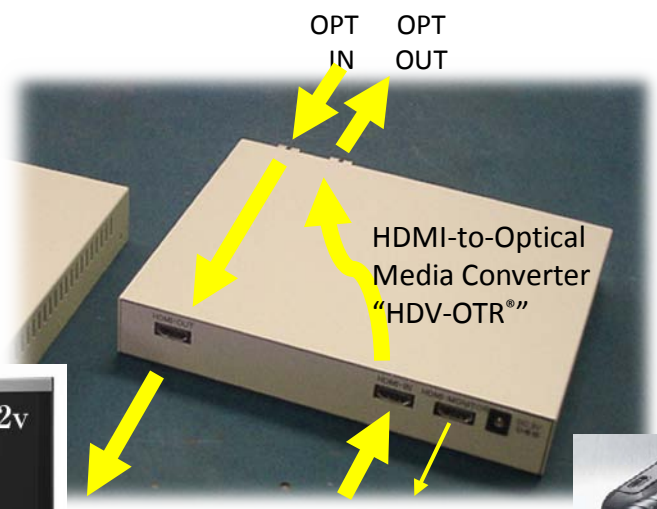
Telemedicine Experiment at Suginami Medical Association

Sony Corporation

Typical noises caused by compression
(Left: Block Noise, Right: Mosquito Noise)

Experiments





HDMI-to-Optical Media Converter for High Definition Moving Pictures ”HDV-OTR®” (E-LambdaNet Corp.)

Results and Discussion

Clinic doctors from five different specialties conducted diagnosis and proved the data compression is not appropriate for telemedicine.

A: GI-POF Non-compressed Transmission → Kept very high quality video images. Most diagnosis can be done. No delay.
B: Videoconference System → Once the patient moved, block noises occurred and diagnosis was hard. Patient responsiveness was bad caused by the delay.
C: Web Camera System → Easy and cheap, but picture and its color were terrible. Diagnosis was impossible.

Left: GI-POF System, Middle: Videoconference System, Right: Web Camera System

Possibility of Diagnosis (0: impossible – 9: attractive)

Specialty	A: Full HD GI-POF	B: Full HD Videoconf.	C: HD Web Camera
Dermatologist (diagnosis of skin)	9	3	0
Ophthalmologist (diagnosis of eye)	9	3	0
Otolaryngologist (diagnosis of ear, nose & throat)	1	1	1
Physician (verbal consultation)	9	3	3
Orthopedist (showing MRI)	3	3	3
Average PD Value	6.2	2.6	1.4

PD Value (Possibility of Diagnosis) **Scoring**:
0 = impossible, 1 = somewhat possible, 3 = possible, 9 = attractive

This research is supported by the Center for Research Promotion (CRP) in Keio University, and the Japan Society for the Promotion of Science (JSPS) through its “Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program).

Contact:

Academic Affairs Center (Hiyoshi Campus), Keio University

Phone: +81-45-564-2518　Fax: +81-45-562-3502

E-mail: sdm@info.keio.ac.jp

http://www.sdm.keio.ac.jp