

Division of Intelligent System Engineering

Period: From April 1st, 2016 Through March 31st, 2021

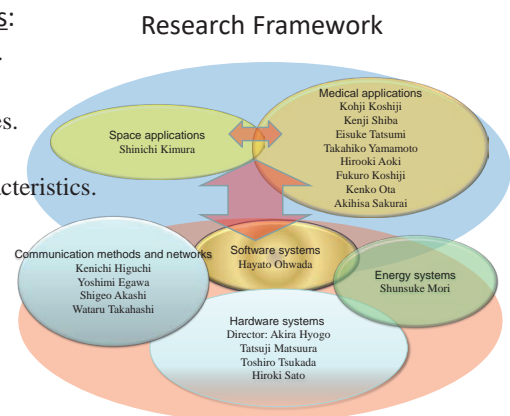
Members of the Division :		3 Visiting Professors (Kohji Koshiji, Professor Emeritus, and 2 others)
Director:		
Akira Hyogo,	Professor, *1	2 Visiting Associate Professor (Hirooki Aoki, Fukuro Koshiji)
Members:		7 Visiting Researchers (Tatsuji Matsuura, and 6 others)
Shinichi Kimura,	Professor, *1	
Kenichi Higuchi,	Professor, *1	
Takahiko Yamamoto,	Lecturer, *1	
Ryo Kishida,	Assistant Professor, *1	*1 Department of Electrical Engineering, Faculty of Science & Technology
Dairoku Muramatsu	Assistant Professor, *1	*2 Department of Industrial Administration, Faculty of Science & Technology
Hayato Ohwada,	Professor, *2	*3 Department of Information Sciences, Faculty of Science & Technology
Shunsuke Mori,	Professor, *2	*4 Department of Applied Electronics, Faculty of Industrial Science and Technology
Shigeo Akashi,	Professor, *3	*5 Department of Applied Mathematics, Faculty of Science Division I
Kenji Shiba,	Associate Professor, *4	
Yoshimi Egawa,	Professor, *5	

Objectives

To research and develop human-like, human-friendly intelligent systems with autonomy for medical and space applications by amalgamating different engineering technologies and sciences, thereby making a contribution to society and mankind.

Research subjects

- Basic research on intelligent systems for medical applications:
A study on body diagnostic systems and implantable medical devices.
- Research on space crafts with autonomy:
A study about downsizing of satellites and higher performance devices.
- Research of hardware:
A study on reconfigurable hardware and hardware with variable characteristics.
- Research on communication method and networks:
A study on wireless communication systems and analytical methods.
- Research on energy systems:
A study on an efficient use of the energy.
- Research of software and theory:
A study on inference systems and so on.



Current state and future perspective

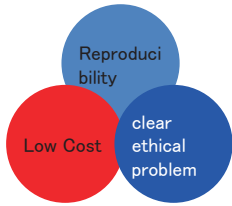
- Each group has a lot of study results for a basic part of an intelligent system.
- We will share the knowledge and merge the results to solve further problems.
- We will have a joint research with another center and/or division for development with the fields that related or applied fields.
- We will activate the student's promotion more, and to lead to the research by the doctor's course, make research activities of the division attractive further more.
- More concrete project themes will be settled on for the medical and/or space application, and the prototype systems will be achieved.
- The basic technology will be improved, and the research and development for industrialization will be advanced.

Highlight ①

A Study on Transcutaneous Energy Transmission Systems for an Artificial Heart

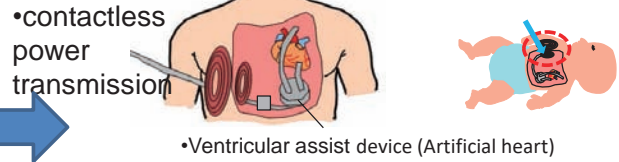
Medical applications

- Koshiji-Yamamoto Group
- Modeling of human body

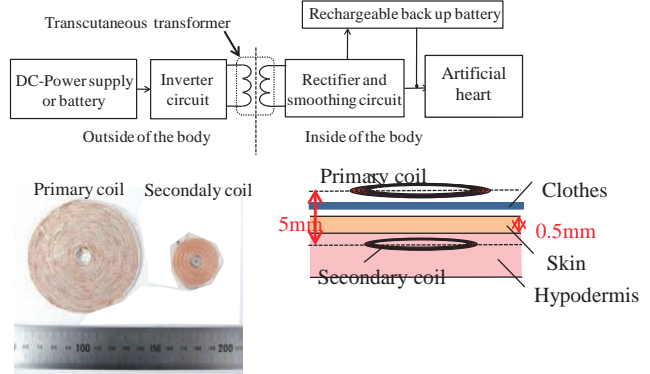
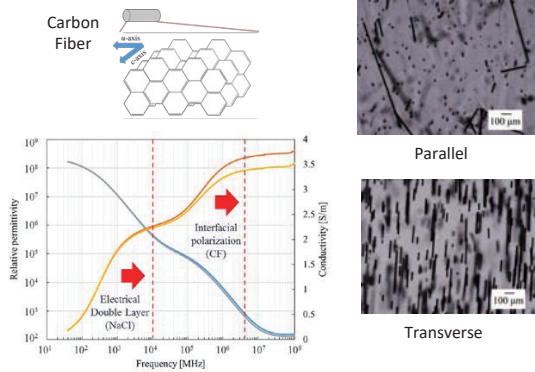


- Shiba Group
- Energy Transmission with cable

Transcutaneous energy transmission : TETS



Putting Carbon Fibers controlled the direction in the Phantom to increase effect capacitance. => The fidelity is improved



A small size implantable high frequency transcutaneous transformer for an infant are developed, and the prospect of achievement is obtained.

Highlight ②

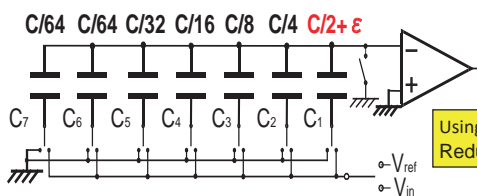
High Resolution Analog to Digital Converter with Small chip area

- Hyogo Group
- Background

😊 ADC is a basic circuit indispensable to achieve medical equipment, space appliances, IoTs, and so on.

😞 Difficult to achieve both Small chip area and High Resolution performance.

Conventional Successive-approximation ADC

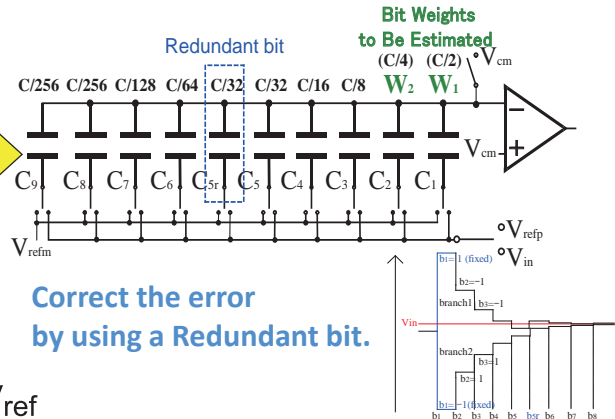


Difficult to Realize the ideal value by Capacitance mismatch (ϵ).

$$\text{Ideal: } V_{in} \cong \left(\frac{1}{2}b_1 + \frac{1}{4}b_2 + \frac{1}{8}b_3 + \dots\right)V_{ref}$$

$$\text{Actual: } V_{in} \cong \left\{\left(\frac{1}{2} + \Delta W_1\right)b_1 + \frac{1}{4}b_2 + \frac{1}{8}b_3 + \dots\right\}V_{ref}$$

Proposed Successive-approximation ADC



Correct the error by using a Redundant bit.

😊 Possibility to realize both Small chip size and High resolution by the proposed technique based on using a redundant bit.