

## AFC Science & Humanities : Round Table Discussion

### ” Humans and Robots: Towards a Society of Coexistence”

The date and time : September 30, 2016 ( 9:00 – 12:30)

Venue : Kitakyushu International Conference Center, Conference Room

Sponsored by : Atsumi International Foundation Sekiguchi Global Research Association (SGRA)

Granted by : The Kajima Foundation

#### 《Background and Aim》

When robots enter the daily human life, how should robots relate to human beings and how should robots work? Is it possible for people and robots to build a relationship based on mutual trust and to establish a society in which both can coexist? Is it possible for robots in the human society to supersede the traditional and limited roles of mutual action based on human model? Furthermore, could highly sophisticated intellectual and creative cooperative activity be induced within the human society to play a new role to increase the mutual relationship between humans?

In this roundtable discussion, we introduce the present situation of development of robots in Japan, Korea, Russia, Europe and China and discuss the problems for the development of robots which aim at coexistence with human beings. We elaborate the discussion about the society in the near future where human beings and robots can coexist inviting the scholars for science and engineering and the young scholars in the fields of philosophy and art as panelists.

#### 《Outline of Program》

Opening Address (9 : 00)

#### **Part 1** Key-note Speech (9 : 10~9 : 30)

##### “COBOT: Robots that collaborate with us”

##### **Dr. Hirochika Inoue (Professor Emeritus, The University of Tokyo)**

In 2015, Japan's Government established Robot Revolution Initiative Council. According to the RRI website, Robot Revolution Realization Committee proposed "Japan's Robot Strategy: Vision, Strategy, Action Plan", and the Japan Economic Revitalization Headquarters decided to make it as the official government policy. This Robot Strategy comprehensively positions all systems that utilize digital and network technologies together with advanced sensors and artificial intelligence as the new concept for what a "robot" is.

Japan has long been a global leader in industrial robots, but it also has an extensive history of experimenting with robots in human-centric activities such as customer service, healthcare, and even simple companionship. Japan's revitalization strategy intends to turn such experiments into a common practice.

The Robot Revolution Initiative Council's goal is to double the use of robots in manufacturing, and increase by twenty-fold robots use in other sectors, including service industries. This is also an effort to deal with the country's declining birthrate and aging population by providing robotic helpmates in industries such as healthcare, agriculture, and the inspection and repair of the country's infrastructure.

The important keyword for such future looking robots is the Collaborative Robots. Government's Robot Revolution cannot be realized without large-scale introduction of robots into our every-day life, where humans and robots will collaborate, coordinate, and coexist, in various scenes of activities in industry, service, welfare, home and natural fields.

My talk will not mention in detail about such general trend or national policy, rather I will focus my talk on the realistic and promising approach for future robotic workers in manufacturing and service industry. After my fifty years pioneering experience in robotics R&D, I am now involved in developing new collaborative robot products. I named it as COBOT. From a viewpoint of robotic company, I will disclose a robotic solution to overcome the serious problems in industry, economy, and society, which are arising from decreasing population, rapid aging and maturing society.

#### **Part 2** Raising Issues (9 : 30~10 : 30)

##### **Report 1. (15 min.) : Coexisting societies of robots and human beings in cartoon animation**

##### **By Dr. Joo-Ho Lee (Ritsumeikan University, Professor)**

Coexisting societies of robots and human beings are not a far future any more. Owing to rapid technology development in engineering, especially robotics and artificial intelligence, it became a near and absolutely certain future. Under the condition of this, lots of researchers are trying to find the solutions for the problem which might occur in this coexisting society.

In this paper, coexisting societies of robots and human beings from a different point of view are discussed. Often science fictions prognosticate future better than scientists or experts. In this paper, coexisting societies of robots and human beings in Japanese cartoons and animations are analyzed and discussed. Japan is one of the most developed country in the world of cartoons and animations. Especially robots in them are not only famous but also various and peculiar. Some robots are described as personality which has same way of thinking, feeling and talking with human beings, e.g. Astro Boy, Doraemon, etc. Some robots gave us message of what makes the difference between robots and human beings, e.g. Maetel in Galaxy Express 999, Tima in Metropolis.

**Report 2. (15 min.) : Mobile Robotic Assistants in Urban Search and Rescue Scenarios**

**By Dr. Evgeni Magid (Innopolis University, Professor)**

A long-standing goal of mobile robotics is to substitute humans with robots in environments unreachable or too dangerous for a human, and one of such domains is urban search and rescue (USAR) domain. This paper describes typical USAR scenarios and problems, which arise in such scenarios. The author presents two approaches for improvement of mobile robot performance within USAR: intelligent tele-operator assistant system and heterogeneous robotic team approach for path planning in point-to-point navigation, which is a work-in-progress.

**Report 3. (15 min.) : Research Project of Human-Robotics Research Center in Kyushu Sangyo University**

**By Dr. Yong-Kwun Lee (Kyushu Sangyo University, Professor )**

In the background of the research, the aged society in Japan has suddenly advanced. Because of the labor shortage in rehabilitation center and/or care house with the medical and care budgets' reduction, the introduction of the robots has been expected in those facilities.

In order to promote the realization of those robots, 1) the technical seeds matched to the necessities in practice, 2) the product design, 3) the business model, 4) the education for the management of those robots are important. Varieties of researchers according to the research and development fields work in the center with cooperating to hospitals and private companies.

The application research groups have developed the three types of rehabilitation robots for walking function trainings, the mobile robot assisting for whole body palsy patient, and the daily life assisting robot on bed. Some of those robots were presented and exhibited in the international conferences and exhibitions.

**Report 4. (15 min.) : Why is "HUMANOID" requested?**

**By Dr. Yoonseok Pyo (ROBOTIS Inc. Research Engineer)**

In this discussion, we present the advantages of humanoid robot from the aspect of coexistence with human beings. From its appearance to function, we survey various humanoid robots and its present situation of development. In addition, the requirements for the desirable coexistence between humanoid robots with human beings are also suggested.

**Part 3 Round Table Discussion (11 : 00~12 : 30)**

**[Reporting the Present Situation]**

**Report 1. (15 min.) : Interaction-awareness for robot action in human environments**

**By Dr. Dirk Wollherr (Technical University of Munich, Professor)**

With recent advances in robotic research, the barrier between robots and humans has been fading, which leads to a major challenge in robotics: ensuring reliable and socially accepted motion in order to realize the human-robot co-existence. A vital factor for achieving this goal is the awareness of the mutual influence between human individuals and the robotic systems. Modern robotic systems have to consider that humans are interaction-aware: they reason about the impact of possible future actions on the surrounding and expect similar anticipation from everyone else. In this talk the importance of considering interaction-awareness is shown by regarding two common robotic tasks: navigating among humans and acting as co-worker in an assembly process. The challenges and possible ways to consider the interaction-awareness are presented.

**Report 2. (15 min.) : Force sensing and control for surgical robots**

**By Dr. Hongbing Li (Shanghai Jiao Tong University, Assistant Professor)**

Many minimally invasive surgical procedures are now performed using teleoperated robotic systems. However, such commercially available systems do not provide significant force

feedback to the surgeon. This reduces surgeon's dexterity and increases tissue trauma when performing the operation. It has been demonstrated that haptic perception plays a key role in the procedure of minimally invasive surgery. The missing of haptic feedback to the surgeon, especially for human delicate tissue, is the main constraint Bottle-Neck for currently used surgical robot to carry out complicate, delicate and safe operation. Thus, research on the mechanism of haptic perception and its realization is endowed with great theoretical and practical significance today.

The mechanism design and control strategies of surgical robots, such as position control and force control, are significantly different from the conventional industrial robots. In this topic, we present some comparison results about the surgical robot and industrial manipulators especially on the control structures. Based on conducting a force resource analysis of surgical tool and one-style design with compact and reasonable structure, this topic aims to grasp the causes of pretention force and precise joint position control. Based on the dynamic model of the surgical robot, the precise force control method and its design for long and slim surgical tool will be discussed. Furthermore, a new reduction mechanism with backdrivable ability, high reduction ratio and low friction will be presented. Then, a force sensor free strategy for surgical robot to achieve haptic perception will be proposed together with the new designed reduction mechanism.

### **[Open discussion among all speakers and commentators]**

**Moderator:** Dr. Evgeni Magid

**Discussant :** All presenters and

Dr. Kyungham Moon (The University of Tokyo, Assistant Professor)

Dr. Yuki Sugihara ( ATRIER OPA Co. Ltd., President)

### **[Speakers & Commentators]**

Japanese researcher (Key-note Speech):

Dr. Hirochika Inoue (The University of Tokyo, Professor Emeritus )

Dr. Yuki Sugihara ( ATRIER OPA Co. Ltd., President)

Invited researchers from abroad:

Dr. Evgeni Magid (Innopolis University, Professor)

Dr. In-Young Ha (Robotis Inc., Vice President)

Dr. Dirk Wollherr (Technical University of Munich, Professor)

Dr. Hongbing Li (Shanghai Jiao Tong University, Assistant Professor)

Foreign researchers in Japan

Dr. Joo-Ho Lee (Ritsumeikan University, Professor)

Dr. Yong-Kwun Lee (Kyushu Sangyo University, Professor)

Dr. Kyungham Moon (The University of Tokyo, Assistant Professor)

### **[Audience]**

Researchers from the University of Kitakyushu and Kyushu Sangyo University and others

Staff members of the municipal office of Kitakyushu and researchers from industries in Kyushu area.

**[Language : English]**