Plenary talker:

Professor Kouhei Ohnishi

PT1 Haptics for Medical Applications

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Robots and intelligent machines in future should adapt themselves autonomously to the open environment in order to realize physical support for human activities. In addition, the physical support by them must be based on the individual's "action" and "sensation" in order that the physical support becomes really human-friendly. Then, the robots must actively recognize the unknown environment according to the individual's action. They also have to transmit the obtained environmental information to the individual in harmony with his or her sensation. Since haptic information is so important as well as visual information and auditory information, development of real-world haptics is one of the important key issues for the purpose.

Haptic information is inherently bilateral, since an action is always accompanied by a reaction. That means the bilateral control with high transparency is necessary to transmit real-world haptic information artificially. The acceleration-based bilateral controller is one of the solutions for the acquirement of high transparency.

There remain many issues to solve for the application of haptics to the physical support for the actual human activities. Haptic system with high transparency should obtain the flexibility in order to extend its function. This paper presents flexible actuation techniques that have high force transferability and flexibility of actuators arrangement. Furthermore, in order to support for human activities in remote environment, bilateral tele-haptics over network is also described.

In summary, this paper introduces the fundamental techniques in haptics including several examples of medical applications, since they are the first target of the real-world haptics.

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In 1975, B.E. degree in Electrical Engineering from the University of Tokyo
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Professional Training and Employment:
1980-1982: Instructor, Dept. of Electrical Engineering, Keio University
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PT2 Membrane Computing and Brain Modeling

Dr. Marion Oswald

Marion Oswald
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Membrane systems (P systems) were introduced as a formal model describing the hierarchical structure of membranes in living organisms and the biological processes in and between cells. In the area of membrane computing there are two main classes of systems: P systems with a hierarchical (tree-like) structure and tissue P systems where the cells are arranged in an arbitrary graph structure. Combining the ideas of P systems and spiking neurons led to a new variant of tissue P systems called spiking neural P systems, where the contents of a neuron consists of a number of so-called spikes. The rules assigned to a cell allow for sending information to other neurons in the form of electrical impulses (spikes) which are summed up at the target cell; the application of the rules depends on the contents of the neuron. We will present some variants of the original model, show some of the latest results obtained in this area, and point out possible applications.

Education:
In 2001, MSc. degree in Computer Science from Vienna University of Technology
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Professional Training and Employment:
Since 1999 member of the European Computing Consortium (EMCC)
2000-2001 Developer at Philips Speech Processing, Vienna
2002-2004 Assistant at the the Institute of Computer Languages, Vienna University of Technology
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PT3 A Simple Adaptive Control of Electrically Driven Flexible-Joint Robots Using Function Approximation Techniques

Professor Jin Bae Park

Jin Bae Park
Vice-President for Research Affairs, Yonsei University, Seoul, Korea

In this paper, we propose a simple adaptive control approach for uncertain flexible-joint robots including motor dynamics. The dynamic surface method is applied to design the simple controller for electrically driven flexible-joint (EDFJ) robots, and the uncertainties in the robot and motor dynamics are compensated by using the adaptive function approximation technique. We prove that all signals in the controlled closed-loop system are uniformly ultimately bounded. Simulation results for three-link EDFJ manipulators are provided to validate the effectiveness of the proposed control system.

Education:
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