ABSTRACTS

Plenary Talker

PT1 Development Outline of Humanoid Robot: HUBO II

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The full size humanoid robot with height of around 1.5m is quit differ from the toy size small ones in many aspects. It should have very stable and well designed structure with little uncertainties. It must strong enough to move its body weight but not so heavy to minimize the torques to drive the body parts. All the electrical parts and sensors must be compact to be fit in the enclosure of the body. We designed such kind of parts including force/torque sensors, inertia sensors and all the driver circuits, internal decentralized control architecture and hardware. Another important task is design walk algorithm. Walking algorithm is composed with two parts: off-line gait pattern design and real time stabilization control. Gait pattern design is to find a periodic function for each joint of leg such that humanoid robot is to walk with desired velocity keeping certain level of stability. We suggested a simple function connected with cubic spline and sine functions with minimal number of parameters. This approach simplifies the parameter adjustment procedure. Play back of gait pattern found from the former process, however, does not guarantee the robot walks in real practice since there are number of uncertainties involved in real situation. The uncertainties include ground inclination, friction, un-modeled vibration of the body. The stabilization algorithm should deal with such kind of problems. Hubo's walk algorithm has 8 levels of hierarchical control architecture to cope with the general circumstances in walking environment. The general issues including mentioned above will be presented.

PT2 Data-driven two degree-of-freedom control for a micropump and microneedle integrated device for diabetes care

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This paper presents a dynamic model for a micropump and microneedle integrated system for diabetes care. A novel data-driven two degree-of-freedom control mechanism is proposed for regulating blood glucose concentration to shorten regulating time while maintaining the stability of the system in the presence of model uncertainties and unexpected disturbances. Exact feedforward linearization, gain scheduling, and data-driven planning technique are applied to improve regulation performance as well as robustness. Simulation results indicate that the proposed control has great potential in drug delivery problems.

PT3 Rescue Robot Systems - From Snake-like Robots to Human Interface

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Intelligent rescue systems with information and communications technologies (ICT) and robotics technology (RT) have been proposed to mitigate disaster damages, especially in Japan after the 1995 Hanshin-Awaji Earthquake. In particular, it is has been stressed the importance of developing robots for search and rescue tasks, which can actually work in a real disaster site. In USA the September 11, 2001 terrorist attack on New York City and Washington, DC, the hijacked plane crash in Pennsylvania, and the Anthrax attack that immediately followed instantly changed people attitude about safety and security in their personal lives. Public safety and security problems are not limited to Japan and the United States, since every country has experienced man-made and natural disasters in the past. Solutions will depend upon new, unconventional approaches to search and rescue. Robotics, information and communications technologies, devices and system integration can play an important role in providing technology that can contribute to Safety, Security and Rescue activities. In this talk, I would like to explain my motivation to start the development of rescue robot systems for the disaster response and discuss necessary technologies that can accomplish search and rescue missions. I also introduce developed rescue robots for the information correction and teleportation human interface.