TACTILE SENSING AND FRICTION-INDUCED SOUND AND VIBRATION

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In recent years, sensing, one of the fundamental areas of cognitive engineering, has advanced with significant contributions from engineering. Although less well understood than audition and vision, the touch, or somatic sensation, has been receiving much attention in engineering and medical fields alike. In the development of robotic grips or virtual reality hardware tactile feedback is essential. On the other hand, tactile sensitivity at finger tips may have a role in diagnosis of and monitoring for rehabilitation for diabetes. Sensory systems consist of three components: sensor network, signal transport (communication), and assessment and decision. In the case of tactile sensing networks in most mammals, four types of sensors are distributed under the surface of skin, each type with a different set of characteristics and role. Preliminary studies suggest that there is a correlation between the perception of a surface quality through touch and the sound and vibration signals emitted during the process. Such a network of sensors is very similar to that used in Japan to detect onset of earthquakes and to investigate the fundamental mechanisms of earthquake generation.

Biography

Adnan Akay is currently Founding Head of Mechanical Engineering Department and Vice President at Bilkent University in Ankara, Turkey. He is on leave from Carnegie Mellon, where he holds the Lord Professor of Engineering Chair and was the head of Mechanical Engineering Department during 1992-2005. He was the Director of the Civil, Mechanical and Manufacturing Engineering Division, and its predecessor CMS, between July 2005 through December 2008. His research lies in Applied Mechanics with emphasis on acoustics, vibrations and friction. He is a fellow of the American Society of Mechanical Engineers and the Acoustical Society of America and a recipient of the ASME Per Bruel Gold Medal for Acoustics and Noise Control (2005).

A GRAND CHALLENGE

"CELL IS A MACHINE"
Engineering Principles of Cells

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A cell may be considered like any other machine that uses energy to perform a task. Unlike human-made machines, a cell's elegance is in its optimized performance. Just like machines for different tasks, different cells have different responsibilities in a body, except that they function collectively for a larger purpose.

As biology moves from a science based mostly on observations to one that also can be described through predictive models, there is an increasing need for the fundamental principles of engineering and sciences to be brought to bear on elements of biology.

Considering a single cell that uses energy, responds to external stimuli and produces signals, it is easy to depict it as a machine. To better understand such a machine requires knowledge from all engineering and science disciplines. The advances in our understanding of how cells and networks of cells function will lead to new sensors and actuators that mimic or are inspired by cell mechanics. Such an understanding will also pave the path for better understanding of various diseases and their mitigation.

The grand challenge posed here is to develop engineering principles that can relate external stimuli – energy processes – signals among the cells and the brain.