TOWARD UNDERSTANDING THE MECHANICS OF TOUCH INVOLVED IN TEXTURE RECOGNITION

Blair Echols[1], Anne Dussaud[2], Junqi Ding[2], Adnan Akay[1]

[1] Dept. of Mechanical Engineering
Carnegie Mellon University
Pittsburgh, PA 15213, USA
bechols@cmu.edu

[2] Unilever Research and Development
Trumbull, CT 06611, USA

The perception of a material and its texture is influenced by several factors. Initial judgments are made based on the appearance of the material. When touched, the mechanoreceptors in the fingers contribute information about the material based on previous experience. Perception of surface texture is often influenced by the sounds produced during sliding contact, or rubbing, of two surfaces. In addition to visual clues, sounds one hears from rubbing often combine with the sensing from touch to develop the subjective feeling perceived. Studies have shown that under certain conditions, sound emitted during rubbing can dominate the sensation through touching, particularly in the absence of visual information. Thus radiated sound while rubbing a surface with fingers plays a significant role in sensing surface textures or surface quality. This presentation describes a method to identify and relate the sounds produced by rubbing hands together, or rubbing on surfaces, to their physical properties. The changes in the auditory clues, when treatments are applied to the surfaces, also affect the perception of surface properties.

Investigation of the correlation between surface properties and sounds emitted requires a measurement setup that provides repeatable and robust measurement conditions. Often such contact has very low contact loads and the resulting sounds have very low amplitudes making it unusually difficult to isolate them from noise in the environment and those from the mechanical system that provides the motion between rubbing surfaces.

The measurement method described includes a unique measurement system that has the fidelity, precision, and repeatability required to make sensitive measurements such as those involving human touch. It allows material pairs to be rubbed against each other at a constant speed with very low contact loads. Measured results that include contact forces and vibration generated by the material pair show some of the sound and vibration characteristics of materials people come into contact with everyday.

Keywords: sound, vibration, perception