Seminar for Mechatronics and Biomedical Systems Engineering

Time: April 7, 9:00-10:30 a.m.

Place: Room 228, Dept. of Mechatronics Building, GIST

Title: Advanced Artificial Arms for Amputees

Speaker:

J. Edward Colgate
Pentair-Nugent Professor, Department of Mechanical Engineering
Northwestern University

Abstract

For well over a century, advances in upper extremity prosthetics – artificial hands and arms – have been frustratingly slow. Even with the advent of myoelectrically controlled devices in the late twentieth century, many patients continued to prefer cable operated arms and hooks that were essentially Civil War era technology. Among the challenges of developing more functional devices, two that remained intractable were the ability to perform coordinated multi-joint movements, and the ability to regain a sense of touch. Recently however, a surgical method known as Targeted Reinnervation (TR) developed by Dr. Todd Kuiken has created new promise that both difficulties might be overcome. In TR, residual nerves from the amputated limb are transferred to intact muscles. The nerves reinnervate both the muscle as well as the overlying skin, creating both efferent and afferent connections to the phantom limb. In this talk, I will give an overview of the TR technique, and I will describe the development of advanced multi-degree-of-freedom prosthetic limbs as well as haptic prostheses for the restoration of senses such as pressure, vibration/texture, and temperature.

Seminar for Haptics

Time: April 6, 2:30-4:00 p.m.

Place: Room 228, Dept. of Mechatronics Building, GIST

Title: Surface Haptics via Friction Modulation

Speaker:

J. Edward Colgate
Pentair-Nugent Professor, Department of Mechanical Engineering
Northwestern University

Abstract

Our group has been developing a powerful new family of surface haptics devices that we call the xPaDs (TPaD, ShiverPaD and SwirlPaD). The most basic device is the TPaD, which controls the coefficient of friction μ between the fingertip and a surface, such as a piece of glass. By modulating μ in response to finger motion, strong haptic effects ranging from textures to virtual bumps on the surface, can be created. A limitation of the TPaD is that it can only produce forces opposite the fingertip motion. It cannot produce other force directions to assist or redirect the fingertip. The ShiverPaD and SwirlPaD are devices that couple friction modulation with in-plane vibration to produce active forces, removing this limitation. In this talk, I will discuss the need for surface haptics, the underlying physics that makes the xPaDs possible, the developments to date, and our plans for future research.