a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

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MECH 493 project: Micromanipulator with high-fidelity force feedback haptics

Background and research goal

Micromanipulators are devices that can scale macro motions of human operators down to micro levels with high accuracy. These devices are commonly used in high-precision tasks such as assembling surface mount components on printed circuit boards (PCB), or manipulating cells during in vitro fertilization (IVF).

The goal of the proposed research is to develop a new type of micromanipulator that not only scales the motions but also provides high-fidelity force feedback haptics, which can significantly improve operators' capability of maneuvering objects. As opposed to commercially available micromanipulators, which typically consist of servomotors and mechanisms of high reduction ratio, the proposed research plans to have two direct-drivable actuators connected via virtual mechanical impedance, i.e., impedance control. This architecture will make the system exhibit 1) motion scaling capability, 2) bidirectional teleoperation, and 3) force feedback haptics.

Tasks to be performed by the student

- Design and build single-axis micromanipulator platform consisting of two actuators, e.g., DC motor and voice coil.
- Design and build electric circuits that drive the actuators.
- Analyze and simulate the dynamics of the designed mechatronic system.
- Implement control algorithms either in real-time processor of FPGA.

Facilities and team:

Main lab location: CEME Building, Room 1059
Team: the students will work with Dr. Minkyun Noh.