HUBERT KIM

Haptic Engineer

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Home: Bay Area, CA

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SKILLS

Firmware Developing

Hardware Fast Prototyping

Finite State Machine

Digital Signal Processing

User Interface Design

Statistical Analysis

Human Subject Testing

EDUCATION

Ph.D.,
Mechanical Engineering
Virginia Tech, *Blacksburg*, VA
Sept 2021

B.S., *cum laude*,
Mechanical Engineering
NYU Tandon, *Brooklyn*, NY
May 2015

SUMMARY

A self-motivated haptic engineer from a start-up robotics laboratory, with proficiency in fast-prototyping with various actuators/sensors/User Interfaces to investigate human-robot interaction. Seeks to join a research team with a fast-paced, project-driven environment to enhance the mutual perception between humans and robots. In the previous project, proposed a novel paradigm of implementing joint torque as a means to guide a motion and evaluated its performance under various physiological conditions via a frequency -domain analysis and a statistical tool.

PROFESSIONAL EXPERIENCE

Ph.D. Researcher | *Assistive Robotics Laboratory* Advisor: Alan T. Asbeck
Exp. Roboticist, Arm Haptic Feedback Project **Sept 2018 - Sept 2021**
This project evaluates the human perceptual ability when the wearable robot guides human arms. The minimum perception ability, JND (Just Noticeable Difference), is observed with varying the background force and elevated movement speed. Also, the tracking performance of the torque feedback was evaluated by applying pulse and step responses to subjects. These works include:

- Conducted Iterative Design process for designing adaptive User Interface.
- Post-processed the user data using MATLAB (segmentation/peak findings/linear regression).
- Analyzed the user data using the JMP and SPSS to find significant effects.
- Interpreted the results relating to the characteristics of human sensory organs located on the muscles and tendons.

Mechatronics Sci., Arm Haptic Feedback Project **Sept 2015 - Sept 2018**
To deliver gentle and transparent torque feedback, manufacturing the low-latency with a full back-drivable exoskeleton is imperative. Thus, a custom-built direct-drive BLDC motor actuator unit was developed. In specific:

- Prototyped various actuator mechanisms, including pulley-driven, geared motor, and full soft-sleeve with magnetic sensors, various load cells, and IMUs.
- Addressed various communications (serial, i2c, CAN) with Maxon, RoboteQ, and Texas Instrument (TI) microcontrollers.
- Provided a solution of Initial Pose Detection of BLDC motor when using Field Oriented Control in TI MotorWare to the wearable application.
- Realized the real-time data communication between Processing.js and CCStudio with the TI's built-in Peripheral Interrupts.

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TECHNICAL SKILLS

Embedded System Programming:
- C / C++ (CCStudio)
- Java Script

Data Acquisition:
- MATLAB
- National Instrument

3D CAD:
- NX
- SolidWorks

Statistics:
- JMP
- SPSS

Data Processing with NN:
- Python
- Tensorflow (Jupyter)

HONORS

Doctoral Scholarship
ICTAS, Virginia Tech
Mar 2016 – July 2020

Best Mechanical Engineering Experience Award for Undergrad
NYU Tandon
May 2015

Inno/Vention Competition with Prototyping Fund
NYU Entrepreneurs Lab
Sept 2014- May 2015

Founder's Day Award
NYU Tandon
April 2015

PROFESSIONAL EXPERIENCE continued

Undergrad. Researcher | *Dynamic System Laboratory* Advisor: Maurizio Porfiri
Signal Processing Sci., Energy Harvesting Project **March 2013 - May 2015**

The project aims to understand smart materials' electrical/mechanical properties of generating electricity when deformed and vice versa. Therefore, smart material's transfer functions against "vibration input-electricity output" (mechanical) and "voltage input-mechanical deformation (electrical)" are explored. The details follow:
- Built experimental setup for measuring mechanical properties (high-speed camera) and electrical properties (LabVIEW data acquisition).
- Derived the transfer functions in frequency domain using MATLAB (curve-fitting).
- Observed how energy harvesting capability changes when the fixed effects (water temperature, underwater level, Etc.) vary.

SELECTED PUBLICATIONS

The Effects of Torque Magnitude and Stiffness in Arm Guidance through Joint Torque Feedback
Kim, H., Asbeck, A. [Submitted]
- 2021
- IEEE Access

Just Noticeable Differences for Elbow Joint Torque Feedback
Kim, H., Asbeck, A. [Under review]
- 2021
- Sci Rep

An elbow exoskeleton for haptic feedback made with a direct drive hobby motor
Kim, H., Asbeck, A.
- 2020
- HardwareX Vol. 8, e00153

Voltage attenuation along the electrodes of ionic polymer metal composites
Kim, H., Cha, Y., Porfiri, M.
- 2016
- J. of Intell Mater Syst Struct

SCHOLARLY REVIEWS

Machine Learning Model Comparisons of User Independent & Dependent Intent Recognition Systems for Powered Prostheses
- 2020
- IEEE Robotics and Automation

Probabilistic Model-based Learning Control for Task-oriented Intention-driven Training with Soft Rehabilitation Robots
- 2020
- Transactions on Mechatronics