

FACULTY OF ENGINEERING  
DEPARTMENT OF MANAGEMENT SCIENCE AND ENGINEERING

End-to-End Design of On-Body Haptic Systems: From Perception to  
Hardware and Application Innovation



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**Abstract:** Vibrotactile feedback has become a popular and accessible method for conveying touch information, with applications in extended reality, robotics, healthcare, and accessibility. Yet designing effective on-body vibrotactile systems remains challenging due to limited perceptual understanding and lack of scalable tools. In this talk, I present an end-to-end approach that connects perceptual research, hardware development, and application design. First, I conducted psychophysical studies to reveal how vibration intensity—but not frequency—affects spatial acuity on the skin, offering practical guidance for actuator placement. Next, I introduce **VibraForge**, an open-source toolkit supporting up to 128 actuators for rapid prototyping of spatial tactile interfaces, now adopted by over twenty labs worldwide. Finally, I demonstrate **AeroHaptix**, a tactile jacket that enhances drone teleoperation by conveying obstacle direction through vibrotactile cues, significantly reducing collisions and improving operator awareness. Together, these efforts illustrate how integrated design—from perception to hardware—can accelerate innovation in wearable haptics applications.

**Bio:** Bingjian Huang is a Ph.D. candidate from the Dynamic Graphics Project (DGP) Lab at the University of Toronto, supervised by Prof. Daniel Wigdor. His research aims to use human-centered research methods to solve haptics problems, from understanding human tactile perception to building innovate tactile toolkits and enabling applications in extended reality, accessibility, and human-robot interaction. His research is published in top venues such as *Transactions on Haptics* (ToH), CHI (Association of Computing Machinery conference on Human Factors in Computing Systems), and *Robotics and Automation Letters* (RA-L). For more details, please see his website: [huangbj16.github.io](http://huangbj16.github.io).