Reimagining Orthopedic Devices Through Compliant Mechanism Design

ABSTRACT
Medical implants have long been designed using traditional methods, relying on multiple parts, rigid components, and sliding surfaces due to their predictability and familiarity. Compliant mechanisms, devices that use mechanical compliance to obtain motion, offer opportunities to reimagine the underlying science behind medical implant design to create systems that are more compatible with the musculoskeletal system. Existing compliant mechanism technologies provide the roadmap for future impact of these devices in the field of orthopedic implants. These principles can then be extended to the development of patient-specific, bio-emulative devices that can improve post-operative recovery. The spatially constrained environment within which medical devices operate, and the unique geometries that single-part compliant mechanisms may demand, make additive manufacture an appealing approach for the fabrication of these medical implants. This presentation will also discuss how voxel-based additive manufacture can be the conduit to highly-customized and precise compliant mechanisms.

BIOGRAPHY
Jared Butler is an Assistant Professor of Engineering Design at Penn State. He received his Ph.D. and M.S. in Mechanical Engineering at Brigham Young University and his B.S. in Physics from Utah State University. Prior to joining Penn State, he was a middle school science teacher at Karl G. Maeser Preparatory Academy. His experience in design includes collaborations with NASA’s Jet Propulsion Laboratory, Intuitive Surgical Inc, and numerous consulting projects in product development and medical device design. He is the recipient of the American Society of Mechanical Engineering’s Compliant Mechanism Award and Student Mechanism & Robot Design Award. His research focuses on mechanical system design including compliant mechanisms, medical devices, deployable and stowable systems, origami-based mechanisms, and hyper-compact devices.