# Origami-inspired Wearable Robot for Trunk Support

Dongting Li[1], Emiliano Quinones Yumbla[2], Alyssa Vanderlinden[2], Thomas Sugar[1], Heni Ben Amor[3],
Hyunglae Lee[2], Wenlong Zhang[1] and Daniel M. Aukes[1,*]

## I. ABSTRACT

We present a wearable "exo-shell" device inspired by the human spine for improving the gait of elderly people during obstacle avoidance tasks. This device – designed and fabricated with origami-inspired techniques – features a serial chain of lockable joints that can be stiffened using a braking system inspired by laminar jamming concepts. Current related work has identified that the trunk plays a crucial role in obstacle avoidance tasks. In this paper, we thus propose an affordable wearable system that can be quickly fabricated and whose design can be adjusted to fit the individual wearer. The design leverages switchable, passive systems, in combination with lightweight materials that remain as "transparent" to the user as possible when inactive. This paper focuses on translating human requirements into a tangible design that addresses the current state of our biomechanics knowledge. We describe the kinematics and forces of our proposed device, describe the performance of our system in a locked and unlocked state, discuss the integration of various sensors into our device, and characterize the performance of the device when locked and unlocked. [1]

## REFERENCES

[1] D. Li, E. Q. Yumbla, A. Olivas, T. Sugar, H. B. Amor, H. Lee, W. Zhang, and D. M. Aukes, "Origami-inspired wearable robots for trunk support," *IEEE/ASME Transactions on Mechatronics*.

*Corresponding author

D. Li, T. Sugar, W. Zhang and D. Aukes are with the School of Manufacturing Systems and Networks, Ira A. Fulton Schools of Engineering, Arizona State University, Mesa, USA {dongting,tsugar,wenlong.zhang,danaukes}@asu.edu

E. Yumbla, A. Vanderlinden and H. Lee are with the School for Engineering of Matter, Transport and Energy, Ira A. Fulton Schools of Engineering, Arizona State University, Tempe, AZ, USA {ejquino1,Alyssa.Olivas,hyunglae.lee}@asu.edu

H. Amor is with the School of Computing and Augmented Intelligence, Ira A. Fulton Schools of Engineering, Arizona State University, Tempe, AZ, USA Hani.Benamor@asu.edu