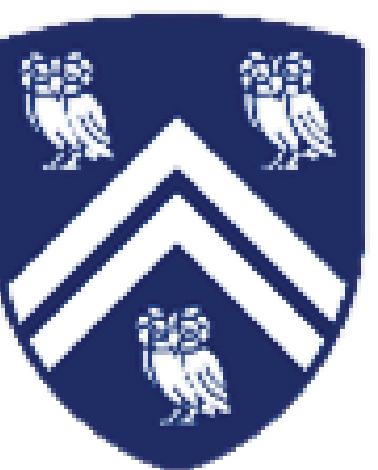


# Wearable Roller Rings to Enable Robot Dexterous In-Hand Manipulation through Active Surfaces

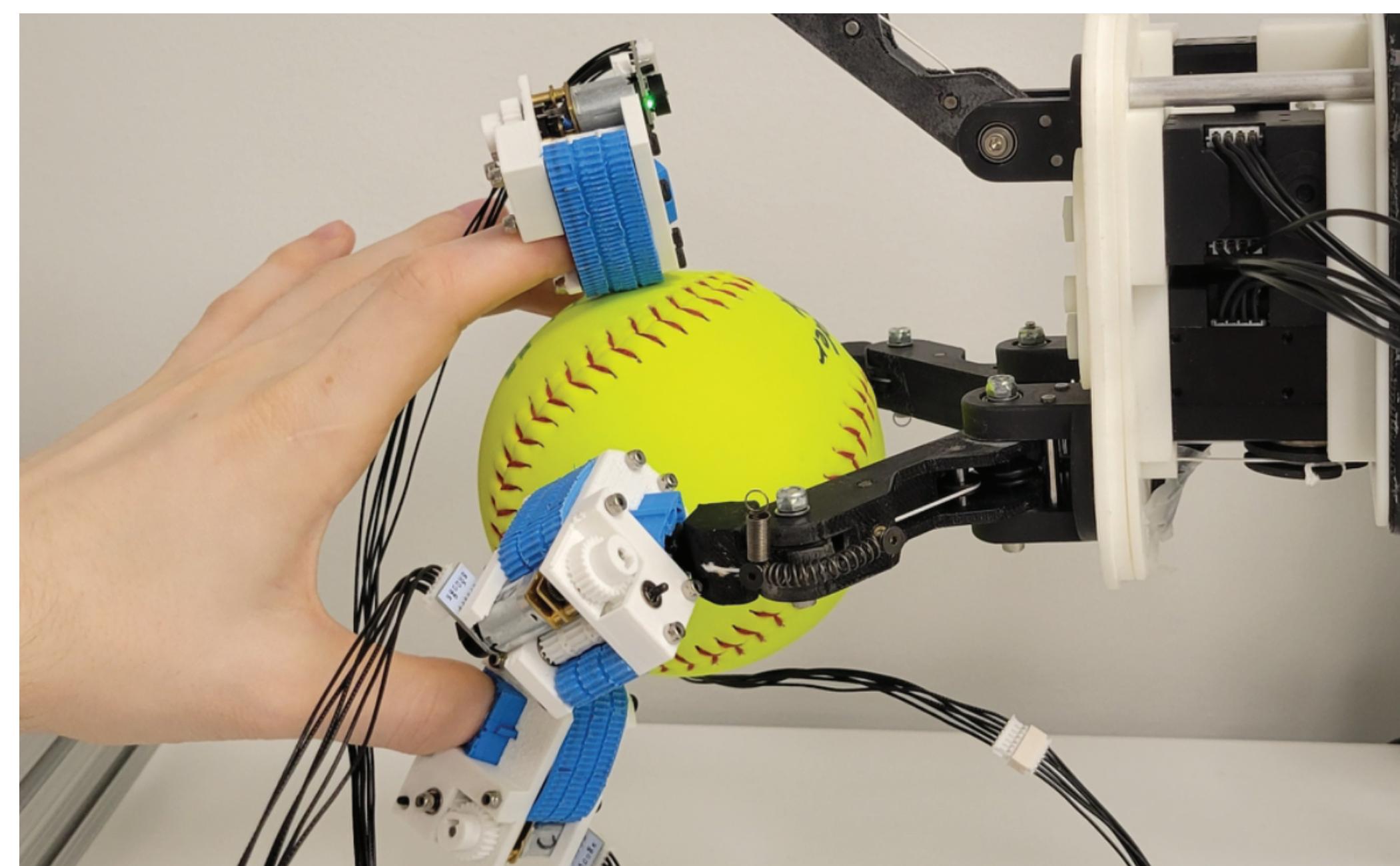


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## Background & Motivation

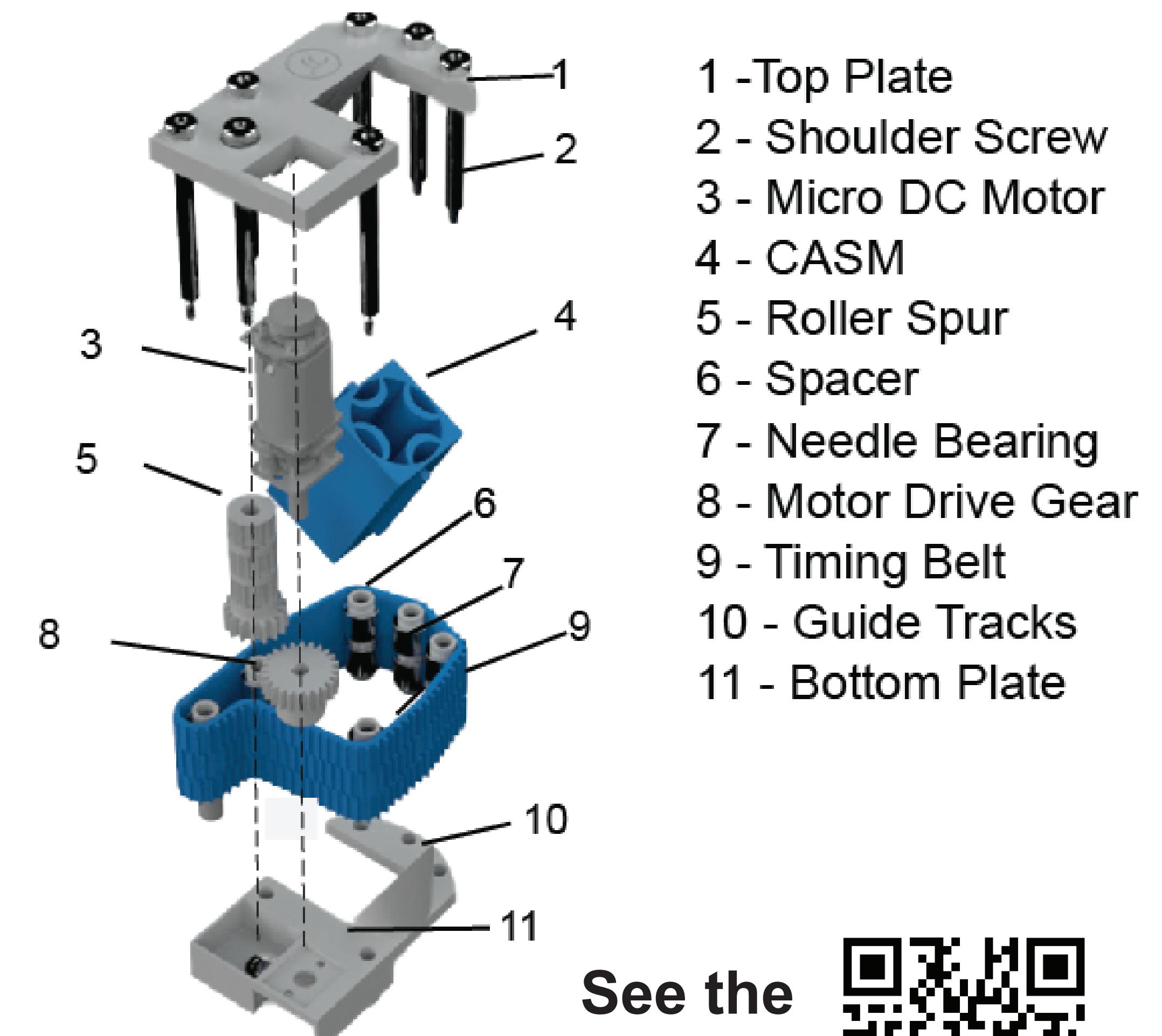
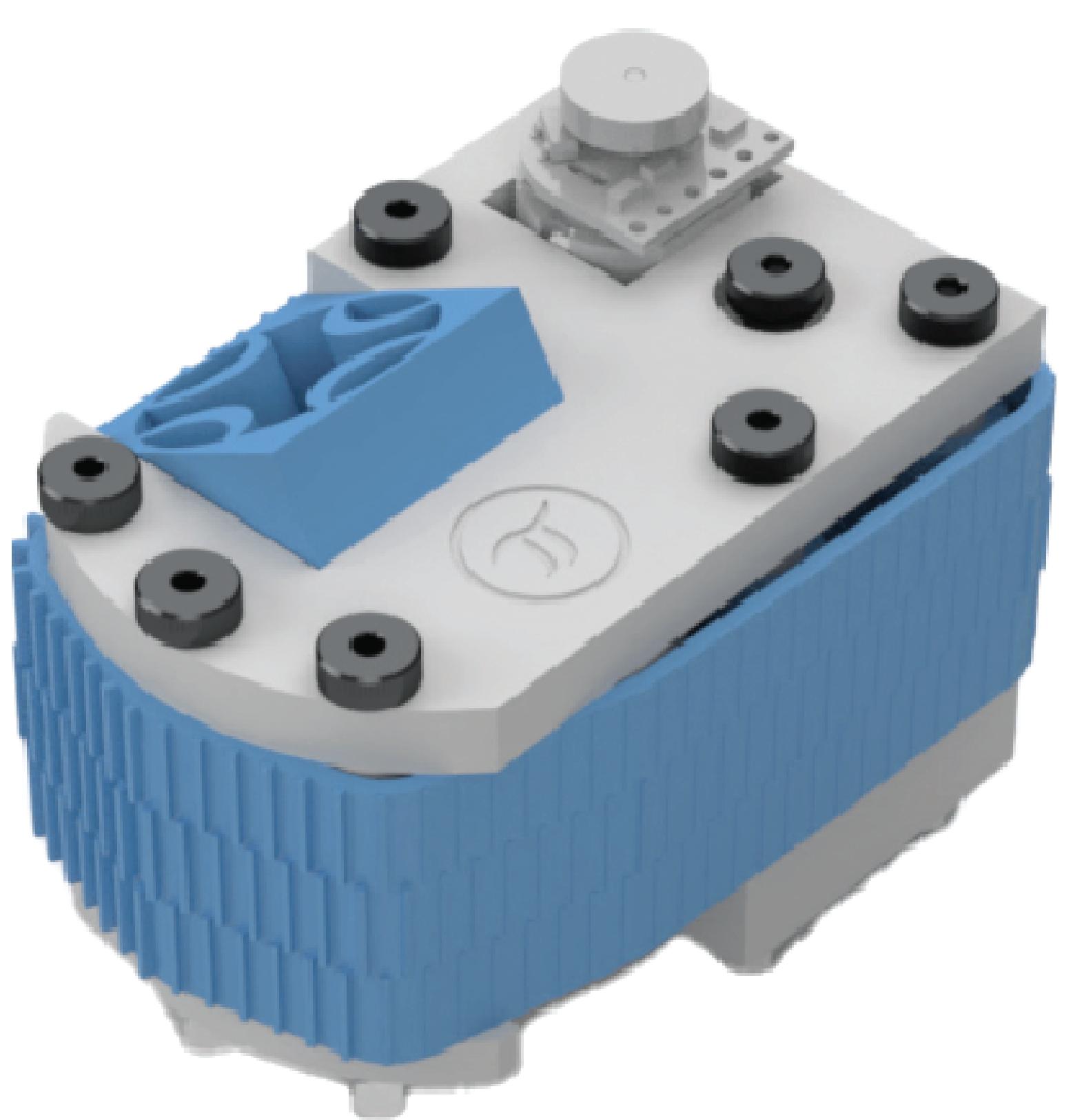
In-hand manipulation is a crucial ability for re-orienting and repositioning objects within grasps. The main challenges are not only the complexity in the computational models, but also the risks of grasp instability caused by active finger motions, such as rolling, sliding, breaking, and remaking contacts. This work presents the development of Roller Rings (RR), a modular robotic attachment with active surfaces that is wearable by both robot and human hands; where as few as 2 RR's can be worn to provide complete in-hand manipulation skill set through differential, non-holonomic object motions.



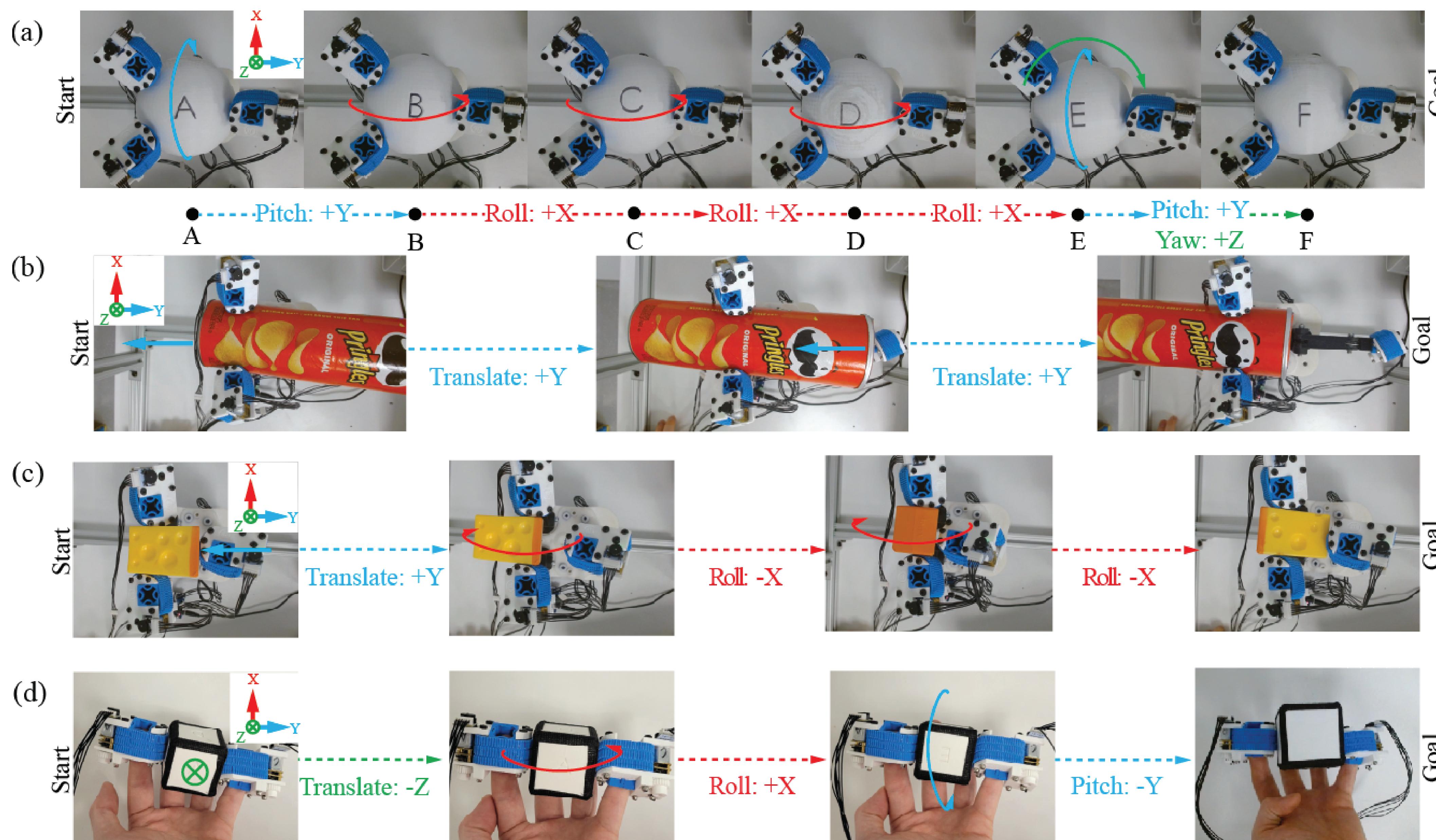
## Objectives

1. Device must be wearable for manipulation augmentation and is low-cost and easy to fabricate
2. Develop a complete manipulation solution through differential manipulations
3. Attachable to any robot and human hands while not changing the existing capability of the original hands

## Design & Experiment Result

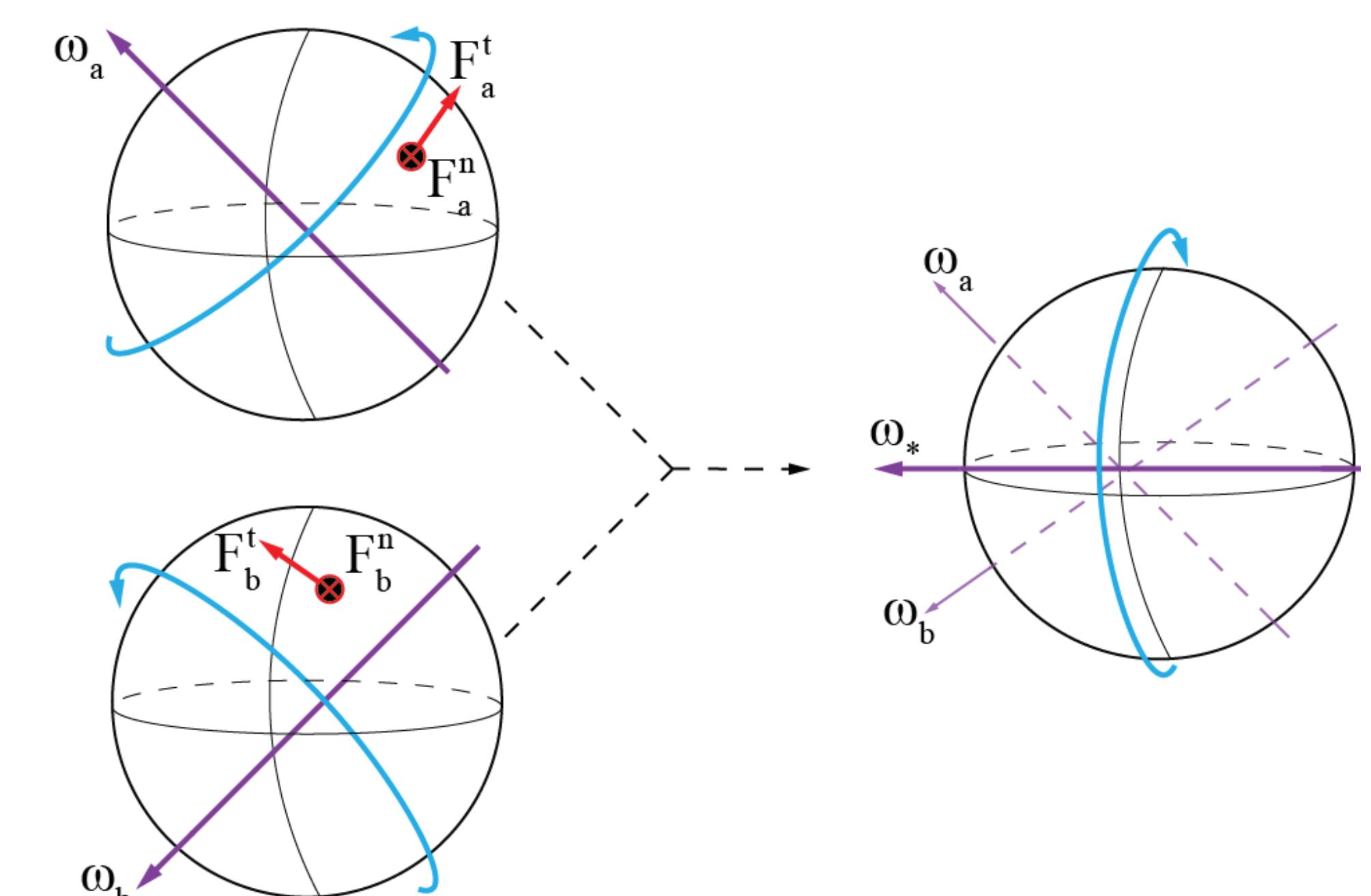


See the  
Roller Ring  
in Action

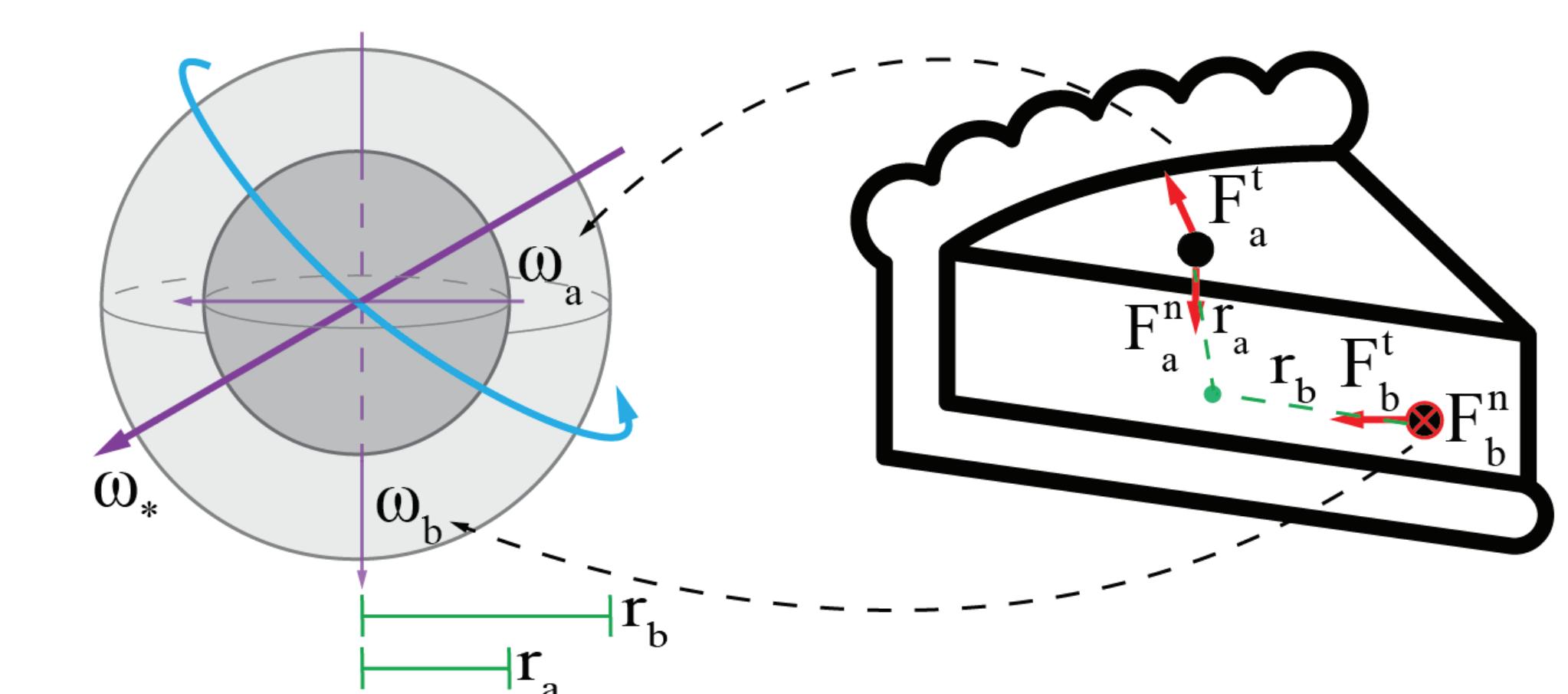


## Motion Model

We developed our proposed Motion Model for Active Surfaces using a Unit Sphere & Multi-Sphere example in order to manipulate objects of variable geometry. This model can be used to by robotic devices for in-hand rotation and translation for any active surface-based manipulation.



In-Hand Rotation of a Unit Sphere



Multi-Sphere Motion Model for Arbitrary Object Shape

## Acknowledgment

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