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EFFECT OF PARTICLE SHAPE AND SIZE ON THE GRIPPING PERFORMANCE OF A GRANULAR JAMMING GRIPPER: A DEM-BASED STUDY

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Abstract

Granular jamming grippers are soft robotic systems capable of conforming to and securely grasping a wide variety of objects by leveraging the solidification of granular media under vacuum (Brown et al., 2010). *The performance of such grippers is closely linked to the physical characteristics of the grains inside the membrane. This study investigates how the shape and size of granular particles affect the gripping behavior using numerical simulations based on the Discrete Element Method (DEM)* (Delaney et al., 2012). *A series of simulations were conducted to analyze different particle geometries (spherical vs. non-spherical) and size distributions (monodisperse vs. polydisperse). The effectiveness of each configuration was evaluated based on*

the number and distribution of contact points established between the granular media and the grasped object during the jamming process. Preliminary results indicate that non-spherical and polydisperse particles tend to increase contact density and improve surface conformity (Delaney & Cleary, 2010; Santarossa et al., 2023), *potentially enhancing grip stability. These insights contribute to the understanding of how granular morphology influences jamming-based gripping, providing useful guidelines for the design and selection of particle types in soft robotic applications.*

Keywords:
Soft Robotics, Granular Jamming, DEM Simulations, Soft Gripper

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