

Octopus Inspired Soft Robots

The octopus, with its soft, muscular hydrostat body and arms, is proficient in locomotion and complex motor functions. Their versatility, "infinite" degrees of freedom, and dexterity have made them an inspiration for soft robotics and synthetic adhesion mechanisms. Octopus suckers have been observed to be utilized for body anchoring, swift maneuvering, object examination and manipulation, and chemo and tactile sensing. Most of these tasks would be impossible without the sucker's main functionality, the attachment mechanism. This study was designed to determine: 1) how pull-off force is impacted if there is no communication with the brain and 2) how much of the attachment mechanism depends on suction versus adhesion. While these parameters may have been qualitatively described in previous studies, they have never been addressed quantitatively. Experiments were conducted on ten Octopus bimaculoides (five female and five male). Pull-off force was measured on intact arms, amputated arms, and amputated arms with a punctured sucker to gain insights into sucker functionality and control mechanisms. The results of these experiments can be used to design efficient synthetic underwater attachment mechanisms. Coupled with soft robotic arms, these synthetic suckers can be utilized to maneuver on and through aquatic environments for exploration and environmental monitoring.