Graduation Project

Integrated design and manufacturing of a soft robotic sucker with high-resolution tactile sensing

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The Bioinspired Soft Robotics group of Istituto Italiano di Tecnologia has a long line of research focusing on soft continuum robotic arms inspired by the octopus [1]. The suckers on the arm of the octopus (see Fig. 1 (a)) have been found to play an important role in how the octopus perceives and manipulates its environment. Recently, the Cognitive Robotics group at TU Delft developed a novel tactile sensor based on visual color mixing using multi-material 3D printing [2] (see Fig. 1(b) and (c))

The goal of this project is to integrate this new sensing principle into a bio-inspired model of an octopus' sucker (see Fig. 1(d)) in order to endow it with high resolution tactile sensing capabilities. These sensorized suckers could be deployed to build soft robotic arms that can perform dexterous manipulation tasks as well as help us build a better understanding of the octopus' manipulation strategies.

Your assignment is to conceptualize, design, print and test a new soft robotic mechanism, inspired by the octopus' sucker, that also integrates the new tactile sensing principle.

The project requires a student with a strong background in parametric design (specifically Grasshopper), and additive manufacturing (specifically PolyJet).

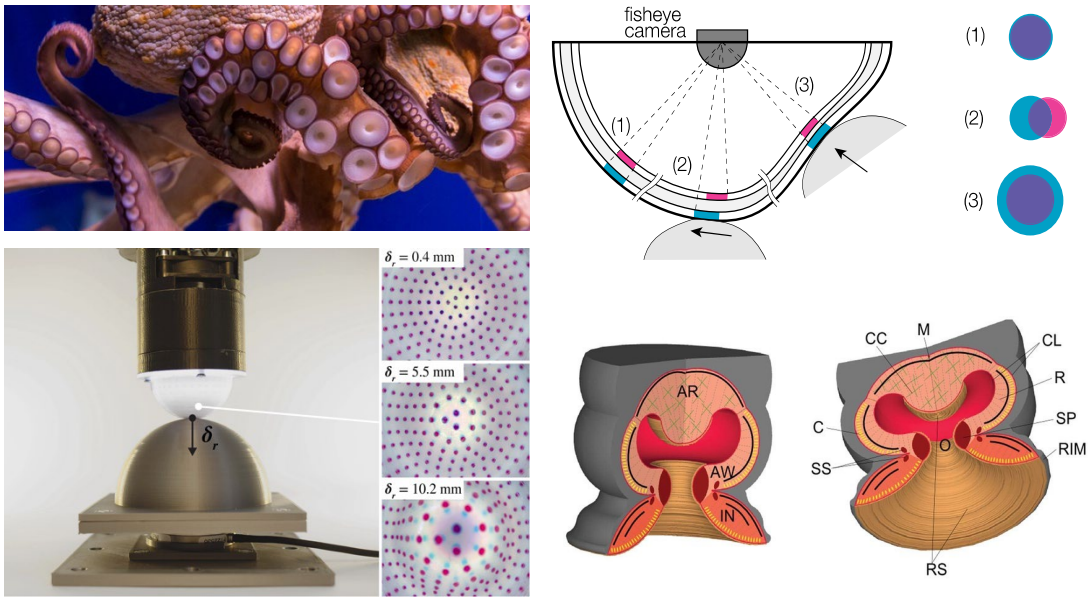

Figure 1: (a) Suckers on the arm of the giant pacific octopus, (b) Schematic of the working principle of the 3D-printed tactile sensor, (3) Soft tactile sensor based on subtractive color mixing, (d) Schematic of the octopus suckers

[1] Mazzolai, B., Mondini, A., Tramacere, F., Riccomi, G., Sadeghi, A., Giordano, G., Del Dottore, E., Scaccia, M., Zampato, M. and Carminati, S. (2019), Octopus-Inspired Soft Arm with Suction Cups for Enhanced Grasping Tasks in Confined Environments. Adv. Intell. Syst., 1: 1900041

[2] R.B.N. Scharff, D. Boonstra, L. Willemet, X. Lin, and M. Wiertleski (2021), Rapid Manufacturing of Color-Based Hemispherical Tactile Fingertips.