Abstract Submitted
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Reverse engineering the euglenoid movement: from unicellular swimmers to bio-inspired robots.[1] ANTONIO DESIMONE, GIOVANNI NOSELLI, SISSA-International School for Advanced Studies, MARINO ARROYO, Universitat Politecnica de Catalunya — Euglenids are unicelluar organisms living in freshwater, which are capable of moving either by beating a flagellum, or by executing dramatic shape changes. These are accomplished thanks to a complex structure made of interlocking pellicle strips, microtubules, and motor proteins. Relative sliding of the pellicle strips, suitably orchestrated, can cause the propagation of a bulge along the body, hence generating a propulsive force. We study the mechanisms by which the sliding of pellicle strips leads to shape control and locomotion, by means of both theory (through the mechanics of active surfaces and its coupling to computational fluid dynamics for the surrounding fluid) and experimental observations. Moreover, we implement them into a new concept of a surface with programmable shape, obtained by asssembling 3d-printed strips in a construct mimicking the biological template. We explore the range of possible geometries achievable by actuating these surfaces, to assess their potential in soft robotics applications. The subtle balance between constraints and flexibility leads to a wide variety of shapes that can be obtained with relatively simple controls, similar to the notion of morphological computation in biological systems.

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